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MANAGEMENT OF DEFENSE ENERGY RESOURCES. REPORT OF THE DEFENSE ENERGY TASK GROUP

Assistant Secretary of Defense (Installations and Logistics)
Washington, D. C.

15 November 1973

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MANAGEMENT OF DEFENSE ENERGY RESOURCES

REPORT OF THE
DEFENSE ENERGY TASK GROUP

15 NOVEMBER 1973

SAVE
DEFENSE
ENERGY

I

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

15 November 1973

INSTALLATIONS AND LOGISTICS

MEMORANDUM FOR Assistant Secretary of Defense (Installations & Logistics)

SUBJECT: Report of Defense Energy Task Group - "The Management of Defense Energy Resources

Subject report, requested by your memorandum of 4 September 1973 to be prepared by 15 November, is submitted herewith. This report has been coordinated with the members of the Steering Group and their comments have been incorporated as appropriate. The report has been printed in three sections, consisting of a classified Executive Summary, an unclassified volume of eight chapters, and a classified volume containing a ninth chapter.

We have found that, for the near term, the peacetime supply of fuel for the DoD is critical, with fuel contract coverage not yet attained for military needs for the first half of FY 74. Deficiencies in the availability of jet fuel are a major concern, and the recent embargo on sales to Western countries has increased the criticality of the supply situation. Operations and training of mobile forces may of necessity be reduced. The potential is high for a combination of unseasonably cold weather and shortfalls of supplies in some locations. Entire installations or major portions of their facilities may have to operate without adequate heating and sustain serious damage to temperature-sensitive equipment. Under such severe circumstances, the continued application of the recently invoked Defense Production Act will be necessary.

We have also found that the many individual organizations in the DoD who are involved in managing energy matters are moving ahead vigorously within their own spheres. Central direction, which has not been necessary heretofore, is lacking; however, our report presents 57 specific recommendations for strengthening the management of DoD energy resources. There are no unresolved dissents from the Steering Group to these recommendations.

In view of the current energy situation, I recommend early activation of a Directorate of Energy to coordinate the prompt implementation of those other recommendations that are approved. If such centralized direction is applied promptly and vigorously, the DoD energy posture can be significantly improved while helping at the same time to cope with the National

problem by reducing DoD needs to the minimum essential for national defense.

I appreciate deeply your support, that of the members of the Steering Group, and that of the organizations who provided personnel to the Task Group in a period of constrained personnel resources. I am especially indebted to all the members of the Task Group for the dedication and professionalism they demonstrated in examining for the first time the overall aspects of DoD energy management in a time of National energy shortages.

N. Sonenshein

N. Sonenshein
Rear Admiral, U. S. Navy
Director, Defense Energy Task Group

OFFICE OF THE SECRETARY OF DEFENSE
DEFENSE ENERGY TASK GROUP

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EXECUTIVE SUMMARY

INTRODUCTION

Historically, the United States has been fortunate in having ample domestic energy sources to spur industrial development and create a high standard of living. Recently, however, a combination of economic, environmental, political, and technological trends has produced a situation in which the future availability of energy to the United States is no longer assured. The serious national security implications of this situation make it a matter of extreme concern to the Department of Defense.

In order to define the energy-related problems facing DoD and to recommend courses of action for solving them, the Defense Energy Task Group (DETG) was formed on 7 September 1973 and directed to make its report to the Deputy Secretary of Defense by 15 November 1973. The principal topic areas covered by the DETG report are:

- World and U.S. energy outlook
- Defense energy requirements and budget impact
- Petroleum storage and distribution
- Fuels standardization
- Naval Petroleum Reserves
- Defense energy conservation
- Energy-related R&D
- Energy organization and management in DoD.

The major findings and recommendations in each of these topic areas are presented in this Executive Summary.

WORLD AND U.S. ENERGY OUTLOOK

The projected near-term annual growth rate of world energy demand is about 5.5 percent, compared to a population growth rate of 3.5 percent. In the United States, energy consumption is going up at the annual rate of about 3.8 percent while population growth rate is 1.1 percent.

Petroleum is currently the most important source of world energy, and it is expected to remain so through the end of this century. At present, more than 81 percent of the world's annual production of petroleum is consumed by industrialized nations, which comprise about 26 percent of the world's population.

Of these major petroleum consumers, all but the U.S.S.R. were required to import oil to meet domestic demands. The United States imported 26 percent of its oil in 1971, Western Europe about 98 percent, and Japan nearly 100 percent. Imported oil is needed to supply one-third of the U.S. demand in 1973. The major petroleum consumers today are expected to continue to be the major consumers to the year 2000. By 1990 Western Europe's consumption will probably equal that of the United States, and Japan's consumption will probably increase to two-thirds or three-fourths that of U.S. consumption, depending on the rate of growth of Japan's nuclear power industry.

In a broad sense, the world energy problem is not one of fuel shortage but primarily one of a geographical maldistribution of resources. As a whole, the industrially developed countries, excluding Communist countries, supplied less than 76 percent of the energy required for their own needs. In contrast, the underdeveloped countries produced 300 percent of their own requirements in terms of energy and exported essentially all the excess production.

DEFENSE ENERGY REQUIREMENTS AND BUDGET IMPACT

The energy requirements and associated funding needs for each of the Services and DoD agencies were reviewed. Difficulty was encountered in obtaining data based on a common method of reporting. The DoD requirements were compared against the total requirements for energy within the United States to determine the impact caused by military demands for specific forms of energy. The energy conservation plans of DoD, previously submitted to the Department of the Interior (DOI) in the form of Matrix II, to comply with the President's directed 7 percent reduction were also reviewed. Petroleum prices and present petroleum shortages were appraised. From the review, the following key conclusions and recommendations were developed.

CONCLUSIONS

Requirements

- The energy demand of the Department of Defense is estimated to remain relatively constant at about 1,800 trillion Btu/year during the FY74 and FY79 period (see Figures 1 and 2).

- The relative size of demand for total energy and petroleum fuels, in descending order, is for aircraft operations, installation support, ship operations, and ground operations (see Figure 3).

- Energy demand for installation support is rising while demand for aircraft operations is dropping, so that by FY79 each will represent about 42 percent of total demand.

- Nuclear fuel, used in about 20 percent of Navy ships, is not expected to be in short supply for the foreseeable future.

- Requirements data contained in this report are believed to be somewhat more reliable than similar figures reported to DOI in Matrix II, but they are still subject to further refinement.

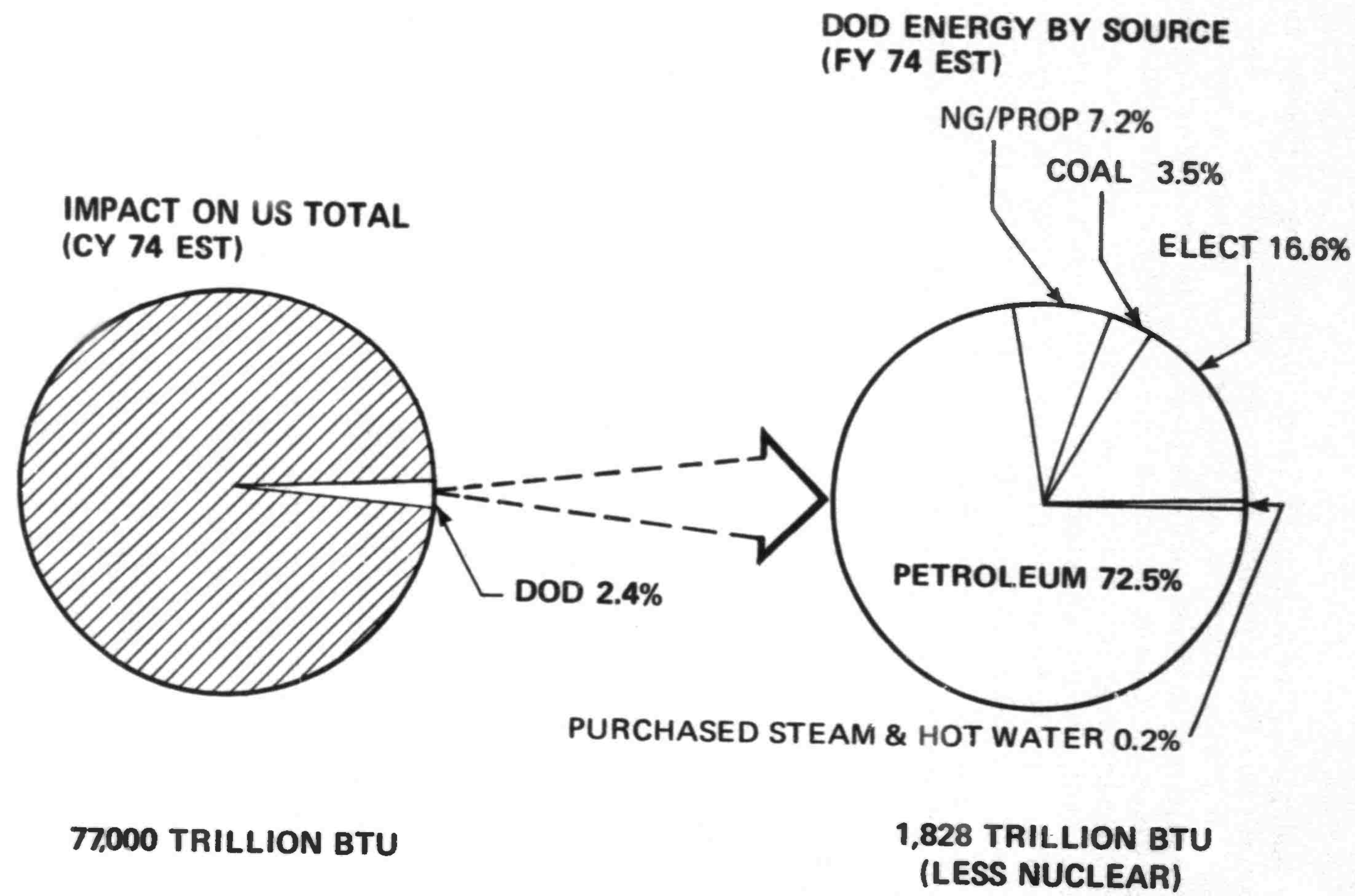

FIGURE 1. TOTAL DOD ENERGY (EXCLUDING NUCLEAR)

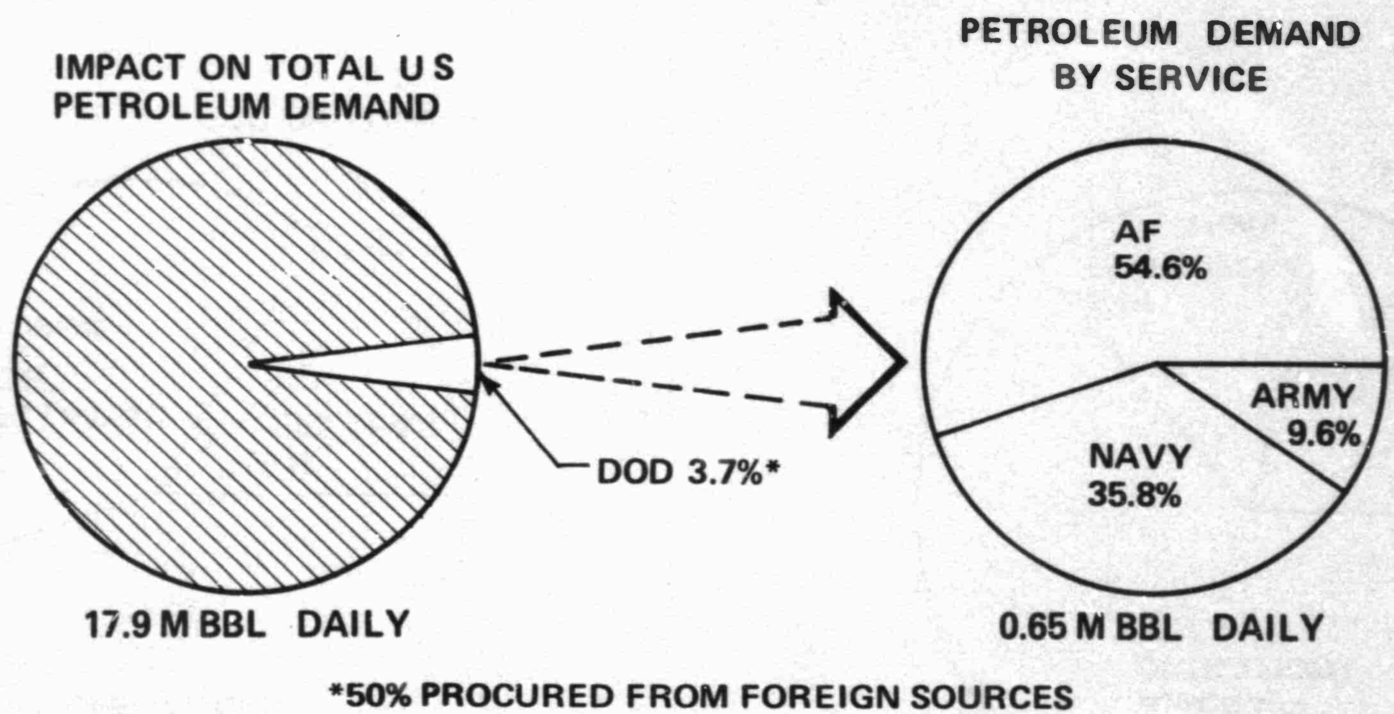

FIGURE 2. ESTIMATED TOTAL FY74 DOD PETROLEUM ENERGY DEMAND

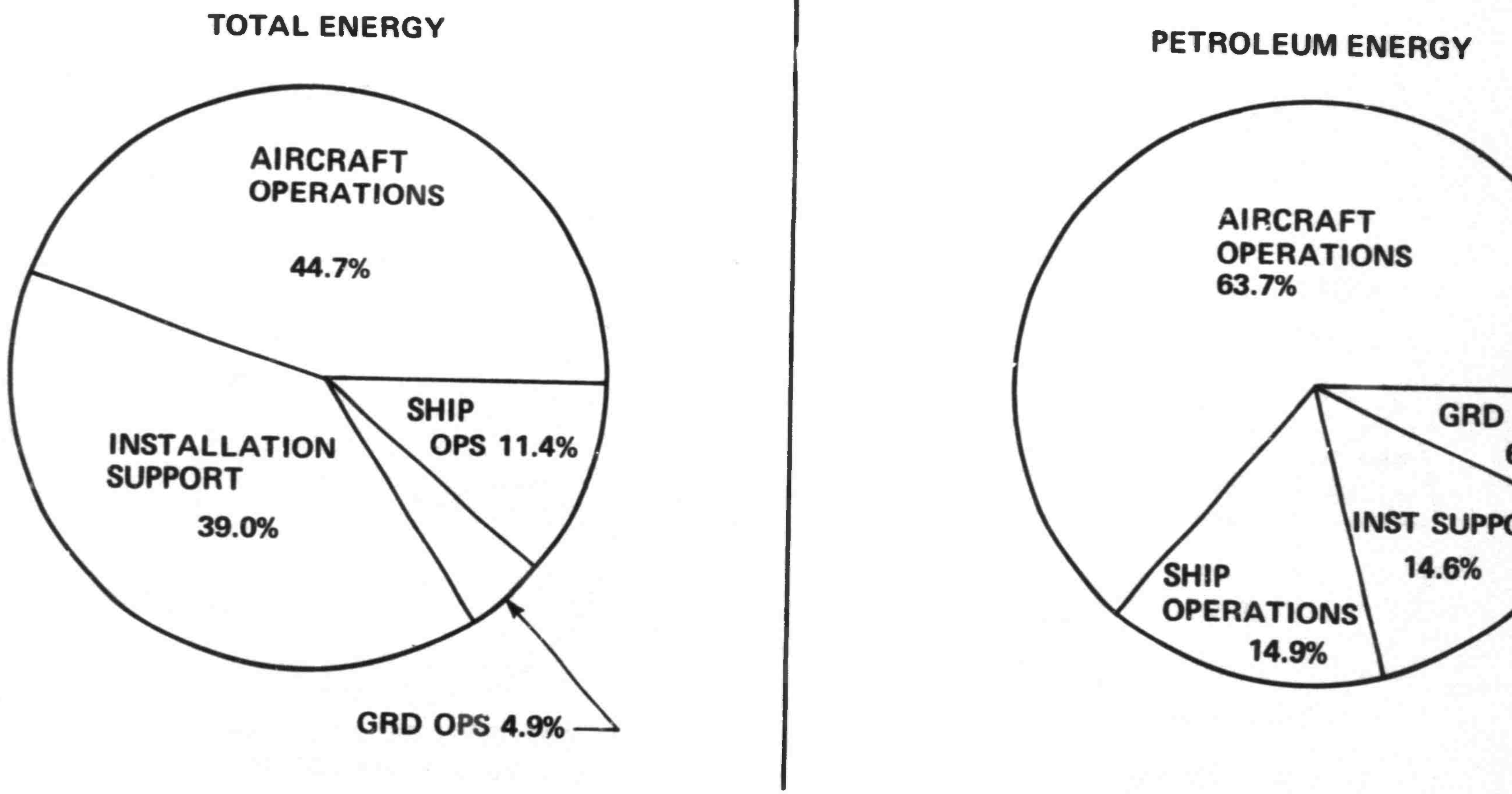

FIGURE 3. ESTIMATED FY74 DOD ENERGY DEMAND (BY OPERATIONAL FUNCTION)

- The Total DoD conservation goal for FY74 as compared to FY73 use is, in effect, 12 percent,* and DETG projections indicate a good probability of achieving it if a vigorous conservation program is carried out.

Impact of DoD Requirements on Total Market

- Currently the DoD worldwide energy demand is 2.4 percent of U.S. demand. DoD worldwide petroleum energy demand is about 3.7 percent of total U.S. demand in FY74 and should continue to decrease. The DoD jet fuel demand within CONUS is about 27 percent of total U.S. production.

- In the event of a major war the DoD petroleum energy demand would be about 1.6 million bbl/day, or less than 10 percent of the projected 1973 U.S. daily consumption.

- A continued denial of petroleum from the Middle East could result in a serious loss of product availability to the United States from international suppliers. This would place more of the DoD requirements in direct competition with the U.S. civilian market.

Availability of Energy To Meet DoD Requirements

- Under peacetime controlled price conditions, as experienced with Phase III and Phase IV controls, DoD cannot be assured of adequate petroleum energy supplies on the open market.

- In wartime, implementation of rationing and other essential controls and priorities will provide adequate energy from Western Hemisphere sources to meet DoD requirements.

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*Consisting of a 7 percent overall reduction directed by the President plus a 7 percent reduction in petroleum alone resulting from the Southeast Asian drawdown. The latter 7 percent equates to 5 percent of overall energy consumption, since petroleum represents only 72 percent of total DoD usage.

- A procedure for peacetime allocation of energy to DoD and continued application of the Defense Production Act will be necessary to ensure an adequate supply under shortage conditions.

- A procedure for allocating energy resources within and among the military departments is necessary.

- The DoD energy reporting and budget procedures do not provide adequate centralized management data for petroleum and other energy resources consumed by DoD.

Impact of Rising Prices on DoD Budget

- The world petroleum market is undergoing dynamic changes that preclude any reliance on historical data for projecting prices or availability.

- Projected price increases will add about $63 million to the DoD energy baseline budget in FY74 ($48 million for petroleum and $15 million for utilities). An additional $686 million cost is probable in FY75 ($618 million for petroleum and $68 million for utilities). The FY74 figure is a net increase even after application of the 7 percent planned reduction in use, directed by the President.

RECOMMENDATIONS*

2-1. The Department of Defense should continue to use the Matrix II baseline to report progress to the Department of the Interior under the Presidential conservation program.

2-2. The Assistant Secretary of Defense (Installations and Logistics) should develop improved energy data reporting procedures to provide better visibility to the total DoD energy requirements and its cost.

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*The recommendations in this Executive Summary retain the numbering established in the main body of the report. Thus, Recommendation 2-1 corresponds to the first recommendation in Chapter 2.

2-3. The Assistant Secretary of Defense (Comptroller) should be prepared for an escalation of Operations and Maintenance (O&M) expenditures in FY74 owing to projected increases in the price of energy.

2-4. The Assistant Secretary of Defense (Comptroller) should adjust the FY75 budget and out year programs to reflect current projections of rising energy costs for utilities as well as POL.

PETROLEUM STORAGE AND DISTRIBUTION

The DoD storage and distribution capabilities for petroleum were reviewed with a particular emphasis on determining their degree of self-sufficiency. Existing DoD policy for stockage levels and the capabilities of ocean and land petroleum storage and distribution assets were examined. The review included both CONUS and overseas assets. Storage capability to meet Peacetime Operating Stocks (POS) and Prepositioned War Reserve Requirements (PWRR), and distribution capability in terms of available ocean tankers and land transportation assets were assessed. From this review the following conclusions and recommendations were developed.

CONCLUSIONS

Storage

- The lack of standardized and reliable data reporting, within both DoD and various Government agencies, makes it difficult to get an accurate assessment of the petroleum storage and inventory situation.

- There is sufficient gross DoD storage capacity worldwide to meet currently established POS and PWRR levels for strategically important petroleum products. However, not enough information is available to show how much of that tankage can be utilized effectively.

- Determination of types of fuels and days of combat support for prestockage requirements are not uniform among the military departments.

- Operating stock levels of jet fuels may have been established at too low a level, possibly requiring use of PWRS for continued operational support during periods of interrupted supply.

- Additional on-base storage capacity is being planned to provide a 30-day stock level for heating oil. However, achieving such levels is proving difficult because of scarcity of supplies.

- Difficulties being encountered in procuring petroleum products may dictate the need for increasing authorized terminal and base stock levels to take advantage of spot procurements and achieving levels on an opportune basis.

Ocean Transportation

- Composition of the world tanker fleet is dramatically shifting by addition of and replacement with larger size tankers that cannot provide support to DoD on a normal basis or in a contingency where physical port constraints exist.

- Minor contingencies requiring increased tanker support through the 1970's (military operations and/or a radical change in DoD procurement sources) can be provided for from the Military Sealift Command-controlled fleet and by chartering additional privately owned tonnage (U.S. and foreign). Adequate-size commercial tankers will still exist during this period. There will be competing demand for these ships but they should be obtainable, though perhaps for a high price. Support of a major overseas contingency of large-scale war would be most demanding on tanker assets but achievable. Current DoD planning calls for reliance on commercial tankers (expanded MSC-controlled fleet and use of effective control Panamanian, Honduran, and Liberian flags).

- The National Defense Reserve Fleet is still a last resort capability, representing minimal assets only until FY77 when scrapping is scheduled to be completed.

Land Transportation

- There appears to be no problem in continued reliance during peacetime on commercial transportation to satisfy most of the DoD requirements.

- The impact of a major contingency on land POL transportation would most likely be overseas and would affect intratheater distribution.

RECOMMENDATIONS

3-1. The Defense Supply Agency should acquire petroleum facilities for use as central distribution points through 3- to 5-year lease arrangements to meet shortfalls in heating fuel and ground operations supply. Associated budgetary and manpower impact should be quantified by DSA and submitted to the Assistant Secretary of Defense (Installations and Logistics) for approval.

3-2. The Defense Supply Agency should conduct detailed joint reviews of storage requirements for FY75 to FY79 (as required by DODD 4140.25 and DOD 4140.25M) and report the results to the Assistant Secretary of Defense (Installations and Logistics) by 1 February 1974 with 1 April annual updates thereafter. The review of storage capabilities should encompass:

- On-base and terminal facilities

- Accuracy of reporting system

- Utilization and material condition of available assets, including programs for necessary repair and rehabilitation of tankage

- Disposition recommendations for malpositioned or under-utilized tankage assets including joint utilization and/or exchange of facilities between the Department of Defense and industry.

3-3. The Services should prepare programs for modernizing strategic, high-usage military POL terminals (e.g., Norfolk, Rota, Sasebo, Subic) to accommodate tankers up to 80,000 DWT, and review current capability and R&D programs to provide for over-the-beach discharge in view of increasing tanker size.

3-4. The Assistant Secretary of Defense (Installations and Logistics) should ensure that the Military Sealift Command-controlled tanker fleet possesses sufficient small tanker capability to support war and/or peacetime military shallow-draft POL requirements. The current construction program for building nine handy-size tankers is strongly endorsed and should be extended.

9-2. The Assistant Secretary of Defense (Installations and Logistics) should conduct a joint review, with participation by DDPA&E, JCS, military departments, DSA, and MSC to establish uniformity among Services on:

- Selection of fuels to be prestocked
- Number of days of combat support for prestockage requirements based on JCS recommendations.

9-3. The Joint Chiefs of Staff should recommend to the ASD(I&L) a mandatory minimum level for PWRS for all fuels.

9-4. The Joint Chiefs of Staff should rescind policy guidance of reliance on commercial assets in foreign countries as applying against in-theater PWRS.

FUELS STANDARDIZATION

The policy, history, and present status of fuels standardization within DoD and the military services were examined. The examination included a review of the overall guidelines that have been established for a Defense Standardization Program. Specific standardization actions such as those dealing with AvGas 115/145, Navy Standard Distillate Fuel, and the Air Force effort to replace JP-4 and JP-8 were examined, as well as the NATO attempts to standardize on a single type of diesel fuel and the attempts to standardize on motor gasoline in Europe. From this examination the following conclusions and recommendations resulted.

- DoD policy directives and manuals have not established clear guidelines and organization for an effective Defense Standardization Program for fuels.

- Intraservice standardization has been largely achieved for fuels and lubricants required for weapons systems, particularly those products stored as prepositioned war reserve stock (PWRS). However, interservice standardization has been only partially achieved.

- The Services have contributed to the proliferation of fuel types by specification of performance and test requirements with little apparent regard for the availability of commercial products (see Table 1).

- Standardization has not been achieved, either within or between the Services, for fuels used to operate military installations. However, this lack of standardization is not objectionable because the existing practice of local control has proved flexible, reliable, and responsive to military needs.

- Significant benefits would accrue to the Navy and the Department of Defense by standardization on a single shipboard propulsion fuel when it becomes economically feasible. If this were a diesel type, further potential standardization could be achieved on a single fuel for both shipboard and ground equipment use.

- Standardization on a primary military jet fuel corresponding to commercial Jet A-1 could offer significant net advantages in logistics and fuel management even if not applicable to shipboard and cold weather operations.

- Although military aviation gasoline is currently standardized on AvGas 115/145, the growing scarcity of this product and the fact that it comprises only 4 percent of the total DoD aviation fuel requirement may force a conversion to AvGas 100/130, which is the standard commercial product.

- Current standardization programs in NATO, such as the recent decision to standardize on F-54 diesel fuel, indicate the approach that may have to be taken by the Department of Defense—standardization on the most widely available commercial fuel.

TABLE 1

BULK FUELS USED BY MILITARY SERVICES

Federal Stock No.	Nomenclature	Military or Federal Specification	ASTM Specification	Barrels Procured for Military Services FY73			
				Air Force	Army	Navy	Total
Aviation Gasolines							
9130-179-1135	Gasoline, Aviation, Grade 115/145	MIL-G-5572	D-910-67	7,466,294	121,635	2,032,636	9,644,655
9130-179-1122	Gasoline, Aviation, Grade 100/130	MIL-G-5572	D-910-67	146,336	11,666	436	158,433
6120-160-1636	Gasoline, Aviation, Grade 80/87	MIL-G-5572	D-910-67	1,003	4,761	26,635	32,199
Jet Fuels							
6130-256-6613	Turbine Fuel, Aviation, Grade JP-4	MIL-T-5624	D-1655-6	164,122,154	436,809	7,790,363	172,351,226
6130-273-2379	Turbine Fuel, Aviation, Grade JP-5	MIL-T-5624[1]	D-1655-6[2]	261,428	6,333	25,513,763	25,782,544
9130-551-2265	Turbine Fuel, Aviation, Grade JP-6						
9130-180-6385	Turbine Fuel, Aviation, Grade JP-7						
9130-NSL	Turbine Fuel, Aviation, Grade JP-8 (Kerosene Type)	MIL-T-83133	D-1655-6				
6130-654-0490	Turbine Fuel, Aviation, Referee for JP-4 Grade I	MIL-T-5161	D-1655-6				
6130-654-0461	Turbine Fuel, Aviation, Referee for JP-5 Grade II	MIL-T-5161	D-1655-6	1,306,432	46,355	27,612	1,386,466
6130-753-5026	Turbine Fuel, Aviation, Grade A-1	ASTM-D1655, Type A-1	Same				
6130-551-2264	Turbine Fuel, Aviation, JP-TS	MIL-T-25524					
Motor Gasolines							
6130-160-1616	Gasoline, Automotive, Leaded, Combat Type I	MIL-G-3056	D-439-68T	386,420	4,806,369	360,437	5,333,226
6130-160-1630	Gasoline, Automotive, Leaded, Combat Type II	MIL-G-3056	D-439-68T				
6130-344-4538	Gasoline, Automotive, Leaded, Prelium	FED-VV-G-76	D-439-46T	200,535	572,376	326,263	1,092,194
6130-264-6316	Gasoline, Automotive, Leaded, Regular	FED-VV-G-76	D-439-66T				
6130-160-1637		FED-VV-G-109	D-439-68T				
9130-143-9457	Gasoline, Automotive, No/Low Lead, Other, Research and Development	MIL-G-46015	D-439-68T	475,463	562,663	544,167	1,582,575
9130-543-6451	Gasoline, Automotive, No/Low Lead, Other, Limited Lead	(Spec.)	D-439-66T				
6130-172-6708	Gasoline, Automotive, No/Low Lead, Other, No/Low Lead, Premium	FED-VV-G-1690	D-439-68T	None	32,657	61,667	94,544
6130-167-6775	Gasoline, Automotive, No/Low Lead, Other, No/Low Lead, Regular	FED-VV-G-1690	D-439-66T	1,702,907	3,387,102	1,126,217	5,991,226
Diesel Fuels							
6140-273-2377	Diesel Fuel, [1] NATO symbol F-75, DFM	MIL-F-16884		423,143	6,656,620	5,487,371	14,787,434
9140-366-5266	Diesel Fuel, Grade DF-1, Winter	FED-VV-F-800	D-975-66	120,446	1,452,071	23,148	1,565,666
6140-266-5[illegible]	Diesel Fuel, Regular, DF-2	FED-VV-F-800	D-975-68	2,355,361	1,655,214	1,520,161	5,530,766
[illegible] 5263	Diesel Fuel, Arctic, DF-A	FED-VV-F-800	D-975-66	1,213,202	147,616	481,426	1,842,546
Fuel Oils							
9140-247-4366	Fuel Oil, Burner, FS-1	FED-VV-F-815	D-396-67	58,335	106,660	55,991	220,996
6140-247-4365	Fuel Oil, Burner, FS-2	FED-VV-F-813	D-396-67	[illegible],721,067	7,457,946	1,951,717	11,130,733
6140-247-4360	Fuel Oil, Burner, FS-4	FED-VV-F-815	D-396-67	146,321	300,670	58,767	505,958
6140-24[illegible]-4356	Fuel Oil, Burner, FS-5	FED-VV-F-815	D-396-67	463,675	704,034	476,468	1,647,177
9140-247-4354	Fuel Oil, Burner, FS-6	FED-VV-F-815	D-396-67	1,506,245	4,655,662	12,436,126	16,601,933
9140-180-6084	Fuel Oil, Diesel (MMSI) DFS	AFPID 9140/1					
9140-161-7716	Fuel Oil, Burner, Low Sulfur FSL						
Kerosene							
6140-242-6746	Kerosene	FED-VV-K-211	—	[illegible]20,723	105,613	66,665	313,410
Navy Distillate							
6140-145-0004	Fuel Oil, Burner, Navy Distillate	MIL-F-24367	—	7,260	None	24,365,444	24,402,624
Navy Special							
61[illegible]-2[illegible]6-8610	Fuel Oil, Burner, Navy Special	MIL-F-856	—	None	16,758	20,824,697	20,841,437

[1] Flash point to 140° F (minimum).

[2] Flash point to 110° to 150° F.

RECOMMENDATIONS

4-1. In view of current petroleum product shortages, the Defense Standardization Board should pursue the standardization of fuels within the Department of Defense with a sense of urgency in order to ensure maximum practicable compatibility with the most readily available sources of supply of satisfactory fuels.

4-2. The Director of Defense Research and Engineering should ensure that the capability to use standard and commercially available fuels as well as multiple fuels is incorporated into weapons and support systems designs where possible.

4-3. The Defense Standardization Board should actively pursue a program that has the ultimate objective of specifying a single petroleum fuel for each of the major mobility systems, that is, aircraft, ship, and ground operations.

4-4. The Defense Supply Agency should review existing and newly developed military POL specifications and testing requirements for compatibility with commercial standards. Where the variations are insignificant, the commercial standard should be adopted (with specified exceptions or supplements if necessary) so as to reduce the need for special military and Federal specifications and redundant testing.

4-5. The Defense Standardization Board should explore the feasiblity of using NATO F-54 diesel fuel for ship propulsion as well as shore use.

4-6. The Air Force should strongly consider phasing in the use of JP-8 as a standard fuel as supply conditions permit, and the Navy should investigate the feasibility of similar action. The ASTM specification for Jet A-1 should be used for this fuel but modified to include FSII anti-icing agent and a corrosion inhibitor.

4-7. The Defense Standardization Board should study standardization on commercially available AvGas 100/130 for use in reciprocating engine aircraft, considering the programmed phaseout of aircraft requiring AvGas 115/145.

4-8. The Defense Standardization Board should pursue world-wide standardization on 91 Research Octane Number (NATO F-46) motor gasoline, and procurement contracts for higher octane gasolines should be awarded only with approved waivers by the Defense Standardization Board.

4-9. The Defense Fuel Supply Center should take the lead in standardizing on commercial fuels to be used by military installations.

NAVAL PETROLEUM RESERVES

The study of Naval Petroleum Reserves included a review of the pertinent legislative history, estimated size of the Reserves relative to DoD wartime requirements, and recent policy statements concerning their exploration and development. From this study, the following conclusions and recommendations resulted.

CONCLUSIONS

- Existing producing capacity is not adequate to satisfy defense requirements for either peace or general war conditions. Maximum estimated potential capacity from the proved recoverable reserves, primarily from NPR No. 1 with small contributions from NPR No. 2 and 3, is estimated to be about 280,000 bbl/day. It would take about 5 years to develop such resources. Significant potential reserves may be available from NPR No. 4 and could be adequate to satisfy DoD requirements in 7 to 10 years. Exploration and development of the full productive capacity of the Naval Petroleum Reserves is, therefore, important to the national security of the United States (see Figure 4 and Tables 2 and 2A).

- The exploration, development, conservation, production, and management of the Reserves will remain the responsibility of the Secretary of the Navy.

FIGURE 4. NAVAL PETROLEUM AND OIL SHALE RESERVES IN CONTINENTAL UNITED STATE

TABLE 2

STATUS OF NAVAL PETROLEUM RESERVES

Reserve	PROVEN RECOVERABLE RESERVES			Potential Reserves
	NPR No. 1 Elk Hills, Kern County, Calif.	NPR No. 2 Buena Vista Hills, Kern County, Calif.	NPR No. 3 Teapot Dome, Natrona County, Wyoming	NPR No. 4 Pt. Barrow, Alaska
Area (acres)	46,095	30,181	9,481	23,680,000
Proved Recoverable Oil Reserves (barrels)	1.0 billion	21 million	43 million	100 million
Estimated Gas Reserves(1) (MCF)	1.3 billion	50 million	8 million	Very significant(3)
Estimated Potential Recoverable Oil Reserves (in addition to proved reserves), (barrels)	482 million	Unknown	Unknown	Very significant(3)
Current Oil Production (barrels per day)	5,000	7,900	500	0
Existing Oil Production Capacity (barrels per day)	(2)	7,900	1,000	0
Estimated Max. Oil Production Capacity from Proved Reserves (barrels per day)	(2)	7,900	5,200	Very significant(3)
Cost to Develop Max. Oil Capacity in Proved Reserves	(2)	-	9.4 million	(3)
Time Required to Develop Max. Production Capacity in Proved Reserves (Months)	(2)	-	24	(3)

(1) Data were not developed on natural gas productive capacity, since Reserves have been developed as oil fields. It is intended that any gas produced in production of fields would be reinjected into reservoirs to maximize oil recoverability. MCF represents thousands of cubic feet at standard conditions.

(2) See Table 2A

(3) Department of the Navy, "Engineering Plan for Assessment and Evaluation of Naval Petroleum and Oil Shale Reserves," March 1973, estimates that total potential recoverable reserves of 10 to 33 billion bbl of oil and 80 trillion cu ft of gas and a total potential deliverable capacity of up to 3 million bbl/day of oil can be developed from NPR No. 4, based on data currently available. The plan estimates exploration and development costs will approximate $150 million and $1.9 billion, respectively, for such a program. In addition, approximately $2 billion to $3 billion in investment costs will be required for pipeline construction from NPR No. 4 to an ocean terminal. Approximately 10 years will be required to complete the full exploration, development, and construction program on an expedited basis.

Source: Office of the Naval Petroleum and Oil Shale Reserves, Fact Sheet, dated 23 July 1973; and Department of the Navy, "Engineering Plan for Assessment and Evaluation of the Naval Petroleum and Oil Shale Reserves," March 1973.

TABLE 2A

NAVAL PETROLEUM RESERVE NO. 1

Production (BPD)	Estimates of Production/Deliverability Capabilities			
	Present Sustained Capability	5 Yr SECNAV Readiness Requirement (1967)	Maximum Sustained Production from Proved Resources	Maximum Sustained Production from Further Exploratory/Development[(1)]
	100,000	160,000	267,440	755,000
Days/Mo to achieve	60 Days	60 Days	60 Months	120 Months
Transportation	100,000 BPD available internally to Reserve boundary. Short 75,000 externally but consider commercial augmentation will be available within 60 days.	Would expand to 160,000 BPD internally to Reserve boundary. Short 135,000 externally but consider commercial augmentation will be available up to 120-140,000 BPD in 60 days. Additional capacity to 160,000 BPD will require added time and funds.	Would expand to 267,440 BPD internally to Reserve boundary. Shortfall of about 242,000 BPD external to boundary; will have to be augmented commercially, and can be done during oil production build-up.	Would expand to 755,000 BPD internally to Reserve boundary. Shortfall of about 730,000 BPD external to boundary; will have to be augmented commercially, and can be done during oil production build-up.
Cost (Date of estimate)	$2M start-up cost (11/73)	$21.6M capital cost (10/72)	$69M development cost (10/72)	$309M development cost (4/73)

(1) Department of the Navy, "Engineering Plan for Assessment and Evaluation of Naval Petroleum and Oil Shale Reserves," March 1973, estimates that an additional 482 million bbl of recoverable reserves and 492,000 bbl/day of productive capacity can be developed in NPR No. 1 within 10 years at a total estimated cost of $19 million for exploration and $290 million for development.

- Funds estimated at \$4 billion to \$5 billion (of which about \$69 million are needed for NPR No. 1 and the remainder for NPR No. 4) have not been available in the DoD budget to support the exploration and development of the full productive capacity of the Reserves over the 10-year period required for such a program. Moreover, any funds realized from necessary production of the Reserves for conservation and readiness purposes are not available to finance further development of the Reserves.

- The significant exploration and development costs of NPR No. 4 may make it desirable for the Government to consider participation by industry in such an undertaking.

RECOMMENDATIONS

5-1. The Secretary of the Navy, with support from the Secretary of Defense, should more fully develop the scope and depth of analysis required to support the "Engineering Plan for the Assessment and Evaluation of the Naval Petroleum and Oil Shale Reserves," dated March 1973.

5-2. The Secretary of the Navy, with support from the Secretary of Defense, should pursue the funding and staffing for the administration of an accelerated program of contractual exploration and subsequent full development of potential reserves of the Naval Petroleum Reserves through the normal budget processes.

5-3. If necessary funding and staffing to support full contractual exploration and development of the Reserves cannot be obtained through the normal budget processes, the Secretary of the Navy should pursue the development of a procurement strategy that will permit industry participation in the exploration, development, and production of the Reserves. The development of such a methodology would require:

- The approval by the Congress of legislation, or the establishment of congressional intent through hearings on such legislation, which would commit the Congress, upon completion of full exploration of the Naval Petroleum Reserves, to authorize the development and production of any oil and gas reserves developed in the Reserves which are in excess of defense requirements, as defined by the Department of Defense. Any such production would necessarily provide for a fair rate of return to be agreed on by the Government and the participating contractors.

- The definition of the procedural aspects of such a method should, as a minimum, provide for:

  - Definition of the scope of the program of exploration required by the Government.

  - Requests for submission by interested firms or consortiums of statements of interest in and proposed technical approaches to the program proposed by the Government. Evaluation of the feasibility and limitations of the program proposed by the Government should be solicited.

  - Establishment of a board of qualified DoD technical, legal, and contractual personnel to review proposals, develop a definitive contractual package, and select those firms or consortiums to whom a request for a detailed technical proposal should be sent.

  - Review by the evaluation board of all proposals to determine those that are technically and economically responsive, and development of a recommendation for award or negotiations leading to an award.

  - Provision for collection and analysis of exploration data developed by the contractors at their own expense.

  - Submission of the foregoing data by the Secretary of the Navy to the Congress for its authorization for further development, production and conservation as defined in earlier congressional authorization.

5-4. The Secretary of Defense should request the Secretary of the Navy to conduct an analysis of the Naval Oil Shale Reserves similar to the one accomplished by the Defense Energy Task Group for the Naval Petroleum Reserves.

DEFENSE ENERGY CONSERVATION

The study of DoD energy conservation included a review of existing instructions, directives, and programs. Sample field surveys were conducted at several military installations and at a Government-owned, contractor-operated plant. Several Navy ships were visited, and discussions were held with Pacific Fleet Type Commanders. An initial conservation seminar was held in San Francisco and a second seminar was conducted at Williamsburg, Virginia. From these reviews, surveys, and seminars the following conclusions and recommendations resulted.

CONCLUSIONS

- The DoD conservation program is consistent with the national program and is, in fact, leading in many areas of energy conservation.
- All Services have long-standing utilities conservation programs that are being revived after a period of neglect.
- OSD direction in energy conservation has been oriented primarily toward cost savings and toward installations rather than tactical operations.
- Heavy emphasis on first cost in military construction has precluded consideration of energy conservation and life-cycle costing benefits.
- The conservation seminars drew a favorable response, and this technique is a good way to stimulate interest in energy conservation.

- The key points brought out by the on-site sample surveys were:

  - An appreciation of the need for energy conservation has not filtered down to the user level.

  - Goals for energy reduction have not been clearly established at the field level.

  - The most successful energy conservation programs are at installations where the commanding officer has taken an active interest.

  - Implementation of specific conservation measures is hampered by low program funding priority and by personnel constraints.

  - Few positive incentives exist to motivate utility system or tactical equipment operators toward improved efficiency in fuel consumption.

  - There is a lack of experienced personnel to negotiate rates with utilities companies.

  - There is good progress in reducing consumption of motor gasoline through driver training, rationing, reduction in number of vehicles, increased frequency of tune-ups, consolidation of trips and other motor pool conservation methods at some activities.

  - At the single GOCO facility surveyed, there is good company management-level emphasis on energy conservation.

  - The fixed cost of providing utilities to an installation is only slightly affected by reductions in force because most utilities systems are not designed to be cut off by sections or to operate efficiently at part load.

  - Currently allocated resources are not adequate to implement an effective conservation program.

RECOMMENDATIONS

6-1. The Assistant Secretary of Defense (Installations and Logistics) should:

- Establish an office to manage its energy conservation program. This effort should include, among other specific actions, sponsoring a DoD-wide information and education program. The logo and slogan (Save Defense Energy) developed by the Defense Energy Task Group should be adopted and distributed widely in the Department of Defense (see Figure 5).

- Establish with the Services a utilities energy conservation program package similar to the existing air and water pollution abatement program packages.

- Revise the military construction program funding to emphasize energy conservation and life-cycle costing considerations.

- Require the preparation of energy impact statements for major new construction (i.e., greater than $300,000).

- Seek to revise current statutory limitations on dollars per square foot of personnel living space to include an appropriate amount for adding energy conservation features.

- Investigate the establishment of a revolving fund of construction capital to be used for short-term, high-return, energy conservation projects.

- Develop and incorporate energy conservation direction in all GOCO contracts.

6-2. The Joint Chiefs of Staff should emphasize the need for energy conservation in tactical operations and should develop a methodology to quantify the impact of fuel shortages on readiness.

6-3. The individual Services should:

- Reemphasize existing conservation programs and institute coordinated programs to include operations as well as installation support with single points of responsibility for energy use management
- Include in their schools and training programs at all levels, orientation on the energy problem and the need for energy conservation
- Institute energy conservation seminars and follow-on field surveys to maintain field level interest as well as receive feedback on accomplishments and problem areas
- Include specific energy conservation items for Inspector General and staff visits to all installations
- Establish an incentive awards program for utility and tactical equipment operators as well as managers
- Reestablish conservation programs such as the Fuel Economy Competition for petroleum fueled ships in the Navy
- Provide for more journeyman mechanics to improve operation of utility systems and facility maintenance
- Establish a utility conservation engineer position at major installations to monitor the conservation program and develop conservation practices
- Increase grade structures in the facilities engineering career field to provide incentives for professional engineers at the installation level
- Provide the services of expert utility rate engineers at the contract review level
- Develop contingency plans for dealing with energy shortages at individual installations

FIGURE 5. LOGO AND SLOGAN FOR DETG SEMINAR PROGRAM

- Institute a vigorous campaign to eliminate or improve the efficiency of temporary buildings, which are characteristically inefficient in their consumption of energy.

ENERGY-RELATED R&D

The study of DoD energy-related R&D included the initial establishment of goals for an R&D program. Two distinct goals must be established for the DoD energy R&D program:

- To participate with other Government agencies and industry and offer incentives to develop new methods for providing DoD with the energy resources it needs, both now and in the future

- To improve the efficiency with which energy is used in DoD applications, and hence to reduce the amount of energy consumed without impairing operational effectiveness.

These two goals are focused directly on the two essential elements of the energy problem: the supply of energy and the demand for it. These are consistent with the objectives of "Project Independence" announced by the President in his energy address of 7 November 1973.

A set of criteria was developed for use in screening specific R&D proposals, and four major R&D program areas were recommended for DoD. A matrix was prepared to form the basis for a DoD strategy in energy R&D. The terms used in the matrix have the following definitions:

- Lead - DoD is the major source of R&D funding.

- Participate - DoD provides a share of the necessary funding in conjunction with other Federal agencies and/or private industry.

- Monitor - DoD does not fund hardware development directly but observes progress closely, makes DoD needs known, and provides resources, analyses, and indirect support (e.g., building insulation test facilities) for specific military adaptations.

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- Incentivize - DoD does not fund hardware development directly but may provide appropriate incentives (e.g., guarantee a market for syncrude subject to the availability of funds), resources, and analyses for specific military adaptations.

The matrix (Table 3) and the conclusions and recommendations for DoD energy R&D are:

CONCLUSIONS

- The DETG review of DoD energy-related R&D has been preliminary and is not necessarily conclusive.
- The matrix of programs and recommended DoD participation therein (Table 3) is the first attempt to define DoD's role in energy R&D.
- Currently planned and programmed R&D projects do not seem to be well aligned with the strategy outlined by the matrix.

RECOMMENDATIONS

7-1. The Director of Defense Research and Engineering and the Services should further refine the matrix presented in this chapter and use it as a basis for evaluating energy-related R&D programs.

7-2. In conjunction with the Assistant Secretary of Defense (Installations and Logistics), DDR&E should perform a detailed review of planned and programmed energy-related R&D projects in order to restructure the overall program to be consistent with the refined matrix.

7-3. The Director of Defense Research and Engineering should assign lead responsibility for each R&D project category to one Service in order to avoid duplication and to assure proper emphasis and coverage.

TABLE 3

RECOMMENDED DoD ROLE IN ENERGY R&D*

R&D PROGRAMS	Time Frame for Application		
	Near-Term (0-7 years)	Midterm (8-15 years)	Long-Term (>15 years)
I. Improvements in Propulsion of Mobile Systems			
• Aircraft Engines	Lead	Lead	Participate
• Aircraft Engine Materials	Lead	Lead	Participate
• Ship Conventional Machinery	Participate	Participate	Participate
• Ship Nuclear Machinery (less reactors)	Lead	Lead	Lead
• Ship Superconducting Machinery	Lead	Participate	Monitor
• Land Vehicles—Diesel & Other Piston Engines	Participate	Participate	Monitor
• Land Vehicles—Turbine Engines	Participate	Participate	Monitor
• Land Vehicles—Transmissions	Participate	Participate	Monitor
II. Development of Alternative Fuel Systems			
• Synthetic Petroleum	Incentivize	Incentivize	Incentivize
• Direct Use of Coal	Monitor	Incentivize	Incentivize
• Hydrogen	Monitor	Monitor	Monitor
• Electrochemical	Monitor	Monitor	Monitor
III. Reduction in Energy Consumption at Bases and Facilities			
• Improved Insulating Materials	Incentivize	Monitor	Monitor
• Heat Recovery Techniques	Monitor	Monitor	Monitor
• Advanced Methods of Energy Storage and Distribution	Participate	Monitor	Monitor
• Total Energy Systems	Participate	Monitor	Monitor
• Advanced Power Plants	Monitor	Monitor	Monitor
IV. Development of Advanced Energy Sources			
• Solar	Monitor	Monitor	Monitor
• Geothermal	Monitor	Monitor	Monitor
• Nuclear Fusion	Monitor	Monitor	Monitor

* The primary justification for a specific program may be related to a military mission in which context the DoD role may differ with that shown in this table.

ENERGY ORGANIZATION AND MANAGEMENT IN DOD

The study of energy organization and management in DoD considered the overall management requirements, the need for energy priorities and allocations, and the need for an energy information system. The present organization was examined to identify any possible deficiencies, and several alternative organizations were analyzed to determine their effectiveness for performing the necessary functions. Existing priority allocation systems were examined to determine their adequacy for energy-related problems. The conclusions and recommendations for DoD energy management, for priorities and allocation of energy, and for development of a Defense Energy Information System (DEIS) are:

CONCLUSIONS

- There is no clearly defined focal point for energy matters in DoD.
- The DoD organization is not presently constituted to handle effectively the anticipated daily operational energy problems of allocations and priorities.
- The Uniform Materiel Movement and Issue Priority System (UMMIPS) is the only official priority specifier within DoD.
- The Joint Materiel Priorities and Allocations Board (JMPAB) is the only organization dedicated to the allocation of materiel within DoD.
- There is no total energy information data base within DoD at present.
- Only in the fuels area, managed presently by the Defense Fuel Supply Center (DFSC), is there a substantial amount of organized data covering all of DoD.

RECOMMENDATIONS

8-1. The Secretary of Defense should establish a Defense Energy Policy Council and an Energy Hardship Panel at the OSD level to approve major energy policies and to resolve DoD energy allocation matters (see Figure 6).

8-2. The Assistant Secretary of Defense (Installations and Logistics) should establish a Directorate for Energy directly under the ASD(I&L).

8-3. The Services should each establish a centralized organization for energy matters comparable with and responsive to the OSD organization.

8-4. The Joint Chiefs of Staff should consider establishing a new organization within the OJCS, patterned after the Joint Transportation Board, should the JMPAB prove inadequate for advising the Energy Hardship Panel.

8-5. The Assistant Secretary of Defense (Installations and Logistics), the Services, and the commanders in chief should consider using the UMMIPS, with modifications, to indicate priorities for energy allocation.

8-6. The Defense Supply Agency should develop a Defense Energy Information System (DEIS), as soon as possible based on the DFSC data bases and procedures.

8-7. The Assistant Secretary of Defense (Installations and Logistics) should establish a standardized reporting format for all the Services as soon as possible to provide a uniform data base on which the immediate DEIS can be built.

8-8. The Assistant Secretary of Defense (Comptroller) should provide resources to DSA to augment its computer system and personnel to support the DEIS development.

8-9. The Assistant Secretary of Defense (Installations and Logistics) should prepare a DEIS System Development Master Plan including requirements, parameters, and interfaces with other information systems, to guide the evolution of the immediate DEIS into the near-term and eventual full-system capability that will include facilities data.

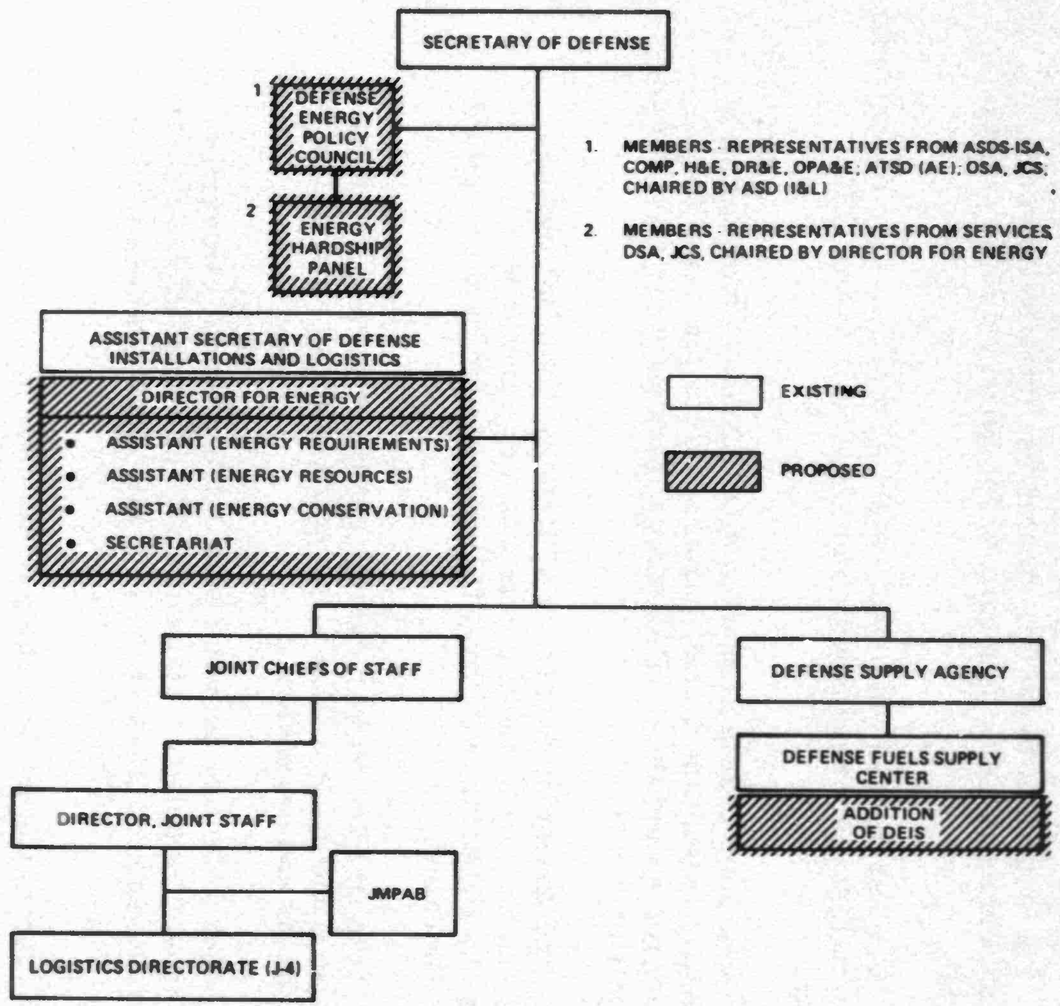

FIGURE 6. RECOMMENDED ORGANIZATION FOR ENERGY MANAGEMENT

T A B L E   O F   C O N T E N T S

Chapter 9, CLASSIFIED SUPPLEMENT, is bound separately.

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CHAPTER 1

INTRODUCTION

1.1 RATIONALE FOR STUDY

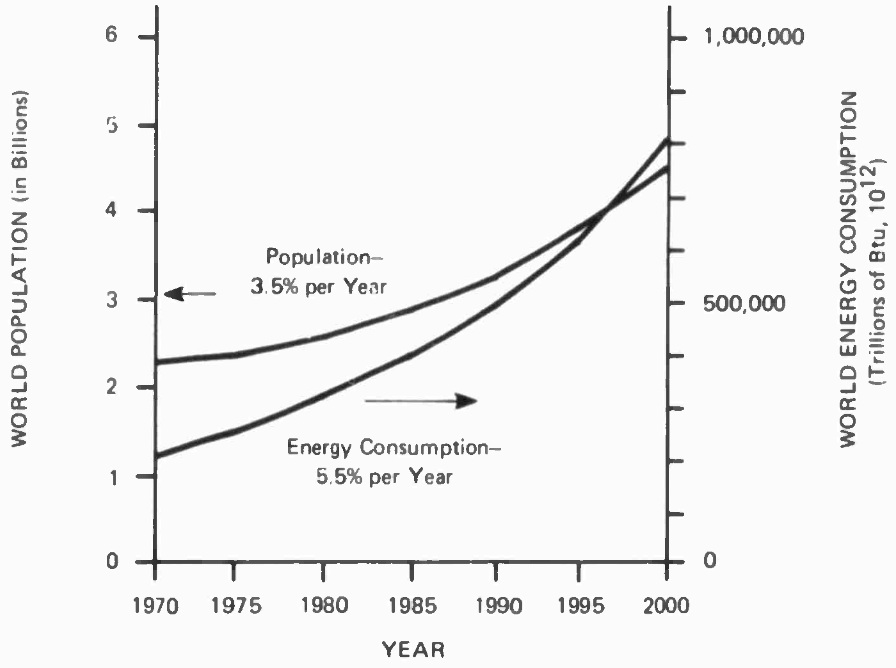
The continued availability of energy at a reasonable price is vital to the well-being of any industrialized nation. Historically, the United States has been fortunate in having ample domestic energy sources to spur industrial development and create a high standard of living. Recently, however, a combination of economic, environmental, political, and technological trends has produced a situation in which the future availability of energy to the United States is no longer assured.

The serious national security implications of this situation make it a matter of extreme concern to DoD. This study has been made to define the energy-related problems facing DoD and to present some recommended courses of action for solving them.

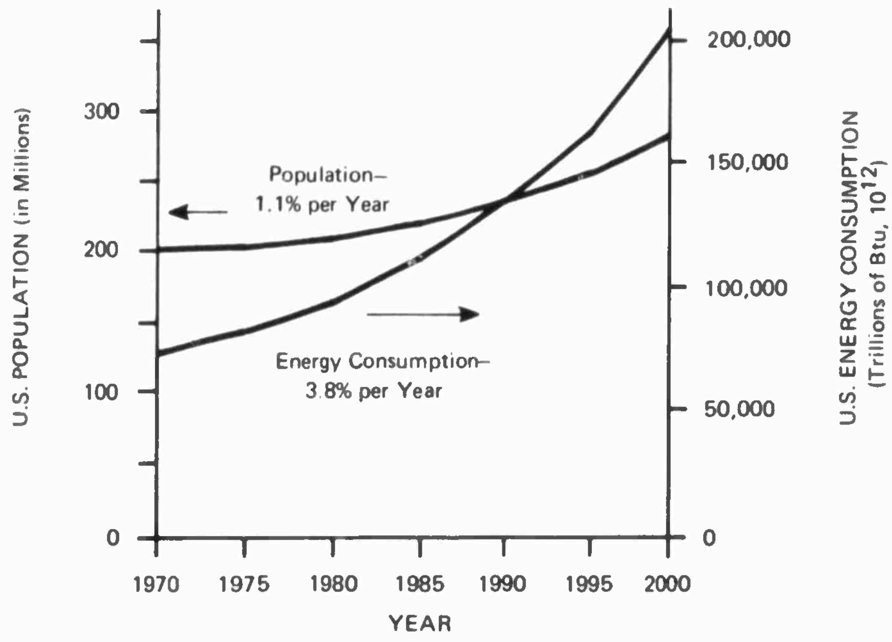
1.2 WORLD ENERGY OUTLOOK

The worldwide demand for energy is going up at a dramatic rate. The reasons for this growth in demand are a growing population and an increasing per capita consumption resulting from an ever-growing and more energy intensive economy. The projected world and U.S. energy consumption curves are shown in Figure 1-1 with their respective population projections. The projected energy consumption assumes a near-term growth rate of 5.5 percent compounded annually for the world and 3.8 percent for the United States.

The Office of Oil and Gas in the U.S. Department of the Interior has estimated that the world consumption of energy in 1971 totaled 212,000 trillion Btu/year. It is estimated that this figure will increase to about 320,000 trillion Btu/year by 1980, which represents a 51 percent increase. By 1990, the estimated consumption of energy will be 476,000 trillion Btu—well over twice the energy consumption of 1971. By the year 2000, the total world energy demand could be almost four times the 1971 level.



Source: Department of Defense, Advanced Research Projects Agency, Impact of Projected National Energy Shortages on the Defense Department, June 1973.



Source: Department of the Interior, United States Energy Through the Year 2000, by W. G. DuPree and J. A. West, December 1972.

FIGURE 1-1. PROJECTED WORLD AND U.S. ENERGY CONSUMPTION VERSUS POPULATION

The percentage of worldwide energy demand satisifed by each major source of energy in 1971 as compared to estimates for 1980 and 1990 is shown in Table 1-1.

TABLE 1-1

PERCENTAGE OF WORLDWIDE ENERGY DEMAND SATISFIED BY EACH MAJOR SOURCE OF ENERGY

Source of Energy	Percent of Energy Years		
	1971	1980	1990
Coal	37	23	18
Liquid Fuels	43	47	43
Natural Gas	18	23	18
Other (Nuclear, Hydroelectric)	2	7	21
	100	100	100

Source: Department of Defense, Advanced Research Projects Agency, Impact of Projected National Energy Shortages on the Defense Department, June 1973.

The percentage of energy demand for liquid fuels is estimated to remain fairly constant, whereas the combined demand for coal and gas are expected to decrease. The primary replacement for coal and gas is expected to be nuclear sources of energy.

Petroleum (as shown in Table 1-1) is currently the most important source of world energy, and it is expected to remain so through the end of this century. At present, more than 81 percent of the world's annual production of petroleum is consumed by industrialized nations, which comprise about 26 percent of the world's population (see Table 1-2).

TABLE 1-2

PERCENTAGE OF WORLD'S 1971 PETROLEUM PRODUCTION CONSUMED BY THE MAJOR INDUSTRIALIZED NATIONS

Country or Region	Percent of World's Population	Percent of World's Oil Consumption
United States	6.0	30.2
Western Europe	9.4	26.4
U.S.S.R.	7.1	15.5
Japan	3.0	9.0
	25.5	81.1

Source: Department of Defense, Advanced Research Projects Agency, Impact of Projected National Energy Shortages on the Defense Department, June 1973.

Of these major petroleum consumers, all but the U.S.S.R. (which exported about 1 million bbl/day in 1971) were required to import oil to meet domestic demands. The United States imported 26 percent of its oil in 1971, Western Europe about 98 percent, and Japan nearly 100 percent. The major petroleum consumers listed in Table 1-2 are expected to continue to be the major consumers to the year 2000. By 1990 Western Europe's consumption will probably equal that of the United States, and Japan's consumption will probably increase to two-thirds or three-fourths that of U.S. consumption, depending on the rate of growth of Japan's nuclear power industry.

In a broad sense, the world energy problem is not one of fuel shortage but primarily one of a geographical maldistribution of resources. As a whole, the industrially developed countries, excluding Communist countries, supplied less than 76 percent of the energy required for their own needs. In contrast, the underdeveloped countries produced 300 percent of their own requirements in terms of energy and exported essentially all the excess production.

1.3 ENERGY OUTLOOK

At its present rate of growth (about 4 percent/year), the demand for energy in the United States will almost double every 17 years. However, the demand for the foreseeable future may be met if conservation measures are adopted, fossil fuel reserves are tapped in the near term, and alternative sources of energy are developed in the longer term. Though many of the most easily tapped reserves of oil, coal, and natural gas have been exploited, vast reserves still remain in the ground. The presently known reserves should be adequate to meet demand until the turn of the century. The U.S. coal reserves alone are estimated to be adequate for 300 years, and the true magnitude of offshore and Alaskan reserves has yet to be determined.

Now and through the next decade there will be continued spot shortages of fuel in the United States and dependence on uncertain foreign sources. Natural gas is currently in short supply, and exploration for new reserves has not kept pace with the depletion of known reserves owing to a lack of economic incentives. Gas supplies from Alaska will probably not be available until the late 1970's. Domestic petroleum production, which has been steadily increasing over the last several decades, has decreased since 1970. About one-third of the U.S. demand for petroleum is satisfied at present by imports. The amount of imported oil will continue to increase until at least the late 1970's, when Alaska North Slope crude oil will become available. Coal and uranium supplies do not pose a problem for the foreseeable future. With prudent management of resources, which implies aggressive conservation efforts as well as exploration and accelerated research and development, the United States could become self-sufficient in energy by 1990.

The price of energy in the United States will increase rapidly, as a result of increased extraction and environmental costs and greater dependence on imports. It appears that a significant price increase must occur to encourage exploration in the United States for deep onshore and offshore gas, the production of shale oil, and development of more efficient extraction methods. Substitute natural gas and imported liquefied natural gas, which will be needed to reduce shortages, will cost several times the current regulated price of interstate gas. The increased U.S. dependence on imported petroleum will result in domestic oil prices being determined by the world market where competition for a limited supply is increasing. In addition, continued emission-control standards will result in premium prices for low sulfur fuels until efficient desulfurization devices can be developed.

1.4 U.S. ENERGY POLICY

In the face of impending energy shortages, the Federal Government has been moving on a broad front to formulate a national energy policy. An interagency report prepared in August 1973 recommended a series of national goals. Two of the goals are directly applicable to the Department of Defense:

- To make provisions to protect against interruption of foreign supplies
- To develop the option to reduce U. S. dependence on foreign supplies of fuel as quickly as possible.

The tasks associated with these goals are to:

- Increase oil stockpiles
- Increase surge production capacity for fuel
- Develop standby programs of voluntary measures, mandatory rationing, and mandatory allocation for use in emergencies *
- Develop programs to counteract maldistribution problems
- Accelerate the development of alternatives to oil
- Reduce the demand for energy.

The energy problem of the Department of Defense is essentially a subset of the national problem. The major challenge to DoD will be to carry out its share of the national tasks without impairing the combat readiness of the various operational commands.

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*A mandatory allocation program at the national level went into effect on 1 November 1973 and covers middle distillates (primarily heating oil and diesel fuel).

1.5 DEFENSE ENERGY TASK GROUP

The Defense Energy Task Group was chartered at the direction of the Deputy Secretary of Defense in September 1973 to study the following areas and make appropriate recommendations:

- Energy requirements and budget impact
- Petroleum storage and distribution
- Fuels standardization
- Naval Petroleum Reserves
- Energy conservation
- Energy R&D
- Organization for energy management.

The chapters that follow will examine each of these topics. The last chapter, issued separately, contains classified discussions on international security affairs, nuclear fuel resources, prepositioned war reserve requirements, and research and development.

CHAPTER 2

DEFENSE ENERGY REQUIREMENTS AND BUDGET IMPACT

2.1 INTRODUCTION

This chapter discusses estimated DoD energy consumption projected through FY79, the impact of DoD requirements on the total market, the availability of energy to meet those requirements, and the impact of rising energy costs on the FY74 and FY75 budgets.

2.2 DOD ENERGY REQUIREMENTS

In FY73, the military departments' worldwide consumption of energy was approximately 2,000 trillion Btu, excluding nuclear fuel. The preliminary estimate for FY74 is approximately 1,828 trillion Btu. The energy consumed by the military departments represents only about 2.4 percent of the total U.S. projected consumption of approximately 77,000 trillion Btu for CY74 (see Figure 1-1).

In this chapter energy usage and projections are discussed by type of fuel and type of use: aircraft, ship, and ground operations, and installation support. "Ground operations" includes consumption by all mobile ground equipment, including combat equipment, administrative and support vehicles, construction equipment, locomotives, cranes, and materials handling equipment. Also included is the Army's relatively small requirement for ship operations. Included in "installation support" is all energy used in the operation of the military departments' worldwide installations, including the heating, lighting, and air conditioning of buildings, facilities, and family housing, and the operation of communications, research, and industrial plants. Table 2-1 lists the major categories of energy required by the military departments and the type of operations in which they are used.

The quantitative data contained in this chapter of the report are actual (FY73) or estimated (FY74 to FY79) consumption by the military departments, prior to implementing the President's directed goal of a 7 percent reduction in consumption of energy. Not included in the report are consumption data for DoD organizations other than the military departments, nor quantities that the military departments

TABLE 2-1

MAJOR CATEGORIES OF ENERGY

Type of Energy	Type of Use			
	Aircraft Operations	Ship Operations	Ground Operations	Installation Support
Nuclear		x		o
AvGas	x			
JP-4	x			
JP-5	x	o		o
Other Jet	x			
MoGas			x	
Residuals				
FO-4				x
FO-5				x
FO-6 and Bunker "C"		o		x
Navy Special Fuel Oil		x		o
Distillates				
DF-A			x	
DF-M		x	x	o
DF-1			x	x
DF-2			x	x
FO-1				x
FO-2				x
Kerosene				x
Navy Distillate Fuel Oil		x		o
Natural Gas and Propane				x
Coal				x
Electricity				x
Purchased Steam and Hot Water				x

Note: x = major user
o = minor user

procure and sell to non-DoD organizations, all of which together consume only about 5 percent of the petroleum fuels purchased by DoD. Also, nuclear and isotopic fuel requirements are not considered further in this chapter because these fuels are not in short supply for the foreseeable future. The consumption of nuclear fuels is discussed in a classified supplement (Chapter 9) to this report.

Estimated requirements for the military departments are projected through FY79 but are subject to change in the out years as refined planning data become available. An almost constant total requirement of approximately 1,800 trillion Btu/year is projected through FY79. This projected level reflects the relatively constant force structure during the FY74 to FY79 period. However, the details of this projection show some trends in which increases in certain types of fuel consumption and end use are balanced by decreases in others.

Petroleum fuels are the major source of energy for DoD, comprising about 72 percent in FY74. Table 2-2 provides the percentage of consumption of major categories of energy in Btu, and Table 2-3 provides more detail on the types of petroleum fuels and lists the estimated consumption of energy in FY74 in units of measure common to the type of energy. About 15 percent of the petroleum products is used for installation support, and 85 percent is used for mobile operations. Jet fuel is the major requirement within the petroleum fuels. Petroleum fuels also provide about 42 percent of installation support requirements measured in Btu. Of the military departments, the Air Force is the major consumer of both petroleum fuels and total energy, and the Navy is the second major user.

Tables 2-4 and 2-5 show that aircraft operations account for about 45 percent of the total military departments' energy requirements, and more than 60 percent of the petroleum fuel requirements during FY74. Table 2-4 also reflects that installation support at 39 percent is the next major requirement. As mentioned previously, the requirements for ground operations encompass the requirements for administrative purposes as well as the tactical forces. Energy requirements for ship operations do not include the approximately 20 percent of the naval ships that use nuclear fuel.

TABLE 2-2

ESTIMATED PERCENTAGE OF ENERGY CONSUMPTION
IN FY74, EXCLUDING NUCLEAR
(Trillions of Btu)

Type of Energy	Army	Navy	Air Force	Total	Percent of DoD
Petroleum	131	497	698	1326	72.5
Natural Gas and Propane	51	31	50	132	7.2
Coal	46	4	13	63	3.5
Electricity	92	94	118	304	16.6
Purchased Steam and Hot Water	1	1	1	3	0.2
Total	321	627	880	1828	–
Percent of DoD Consumption	17.6	34.3	48.1	–	100.0

TABLE 2-3

ESTIMATED ENERGY CONSUMPTION IN FY74, EXCLUDING NUCLEAR

Type of Energy	Army	Navy	Air Force	Total
Petroleum (thousands of barrels)				
AvGas	545	2,004	4,207	6,756
Jet Fuel	3,094	31,140	112,669	146,903
MoGas	3,405	1,685	2,793	7,883
Navy Special Fuel Oil (NSFO)	350	11,035	500	11,885
Navy Distillate Fuel Oil (NDFO)	–	23,912	–	23,912
Residuals (less NSFO)	3,324	7,268	2,231	12,823
Distillates (less NDFO)	12,039	8,274	7,489	27,802
Total	22,757	85,318	129,889	237,964
Natural Gas/Propane (millions of cubic feet)	49,281	29,760	42,000	121,041
Coal (tons)	1,928,000	150,277	550,000	2,628,277
Electricity (millions of watt hours)	7,950,000	8,090,972	10,150,000	26,190,972
Purchased Steam and Hot Water (thousands of pounds)	616,000	1,065,698	725,000	2,406,698

TABLE 2-4

ESTIMATED ENERGY CONSUMPTION BY TYPE OF USE IN FY74, EXCLUDING NUCLEAR
(Trillions of Btu)

Use	Army	Navy	Air Force	Total	Percent of DoD
Aircraft Operations	20	174	623	817	44.7
Ship Operations	*	209	–	209	11.4
Ground Operations	43	23	23	89	4.9
Installation Support	258	221	234	713	39.0
Total	321	627	880	1,828	–
Percent of DoD Consumption	17.6	34.3	48.1	–	100.0

*Minor amount, included in ground operations.

TABLE 2-5

ESTIMATED CONSUMPTION OF PETROLEUM FUELS BY TYPE OF USE IN FY74
(Thousands of Barrels)

Use	Army	Navy	Air Force	Total	Percent of DoD
Aircraft Operations					
AvGas	545	2,004	4,207	6,756	
Jet	3,094	29,229	112,669	144,992	
	3,639	31,233	116,876	151,748	63.7
Ship Operations		35,456	-	35,456	14.9
Ground Operations	7,753	4,050	4,291	16,094	6.8
Installation Support (petroleum only)	11,365	14,565	8,722	34,652	14.6
Total	22,757	85,304	129,889	237,950	
Percent of DoD Consumption	9.6	35.8	54.6		100.0

* Minor amount, included in ground operations

Projections of energy requirements through FY79 by military department are shown in Figure 2-1, and by type of operation in Figure 2-2. Figure 2-1 shows that the Air Force will remain the major user during the time frame, with the Navy the second major user. Figure 2-2 shows that aircraft operations will require the most energy, but that by FY79 requirements for installation support will approach the requirements for aircraft operations. The requirements for aircraft operations will decline slightly from FY74 to FY79, although the requirements will peak in FY75 reflecting increased flight operations associated with the introduction of F-14, F-15, A-7E, S-3, C-9, and AV-8 aircraft types.

The projected requirements for installation support in Figure 2-2 reflect an increase of about 2 percent/year. A small annual increase can logically be expected because of modernization in both installation and mission-related uses. For example, increased energy consumption is a direct result of many factors, including the following:

- Increased number of military housing units
- Improved personnel comfort standards, such as increased floor area per person, privacy, and air conditioning in barracks in support of the All-Volunteer Service
- Large-scale construction of replacement family housing with increased comfort standards
- Replacement of obsolete industrial operations with higher productivity, more highly automated and energy intensive equipment
- Retention of "replaced" buildings for use other than that of their original design, such as administrative spaces in surplus barracks and warehouses
- More energy intensive support of modern weapon systems, such as higher voltage, quality electrical shore power, and air pressure, as well as higher pressure and quality steam going to increasing numbers of berthed ships tapped into shore utilities (going "cold iron") at naval homeports.

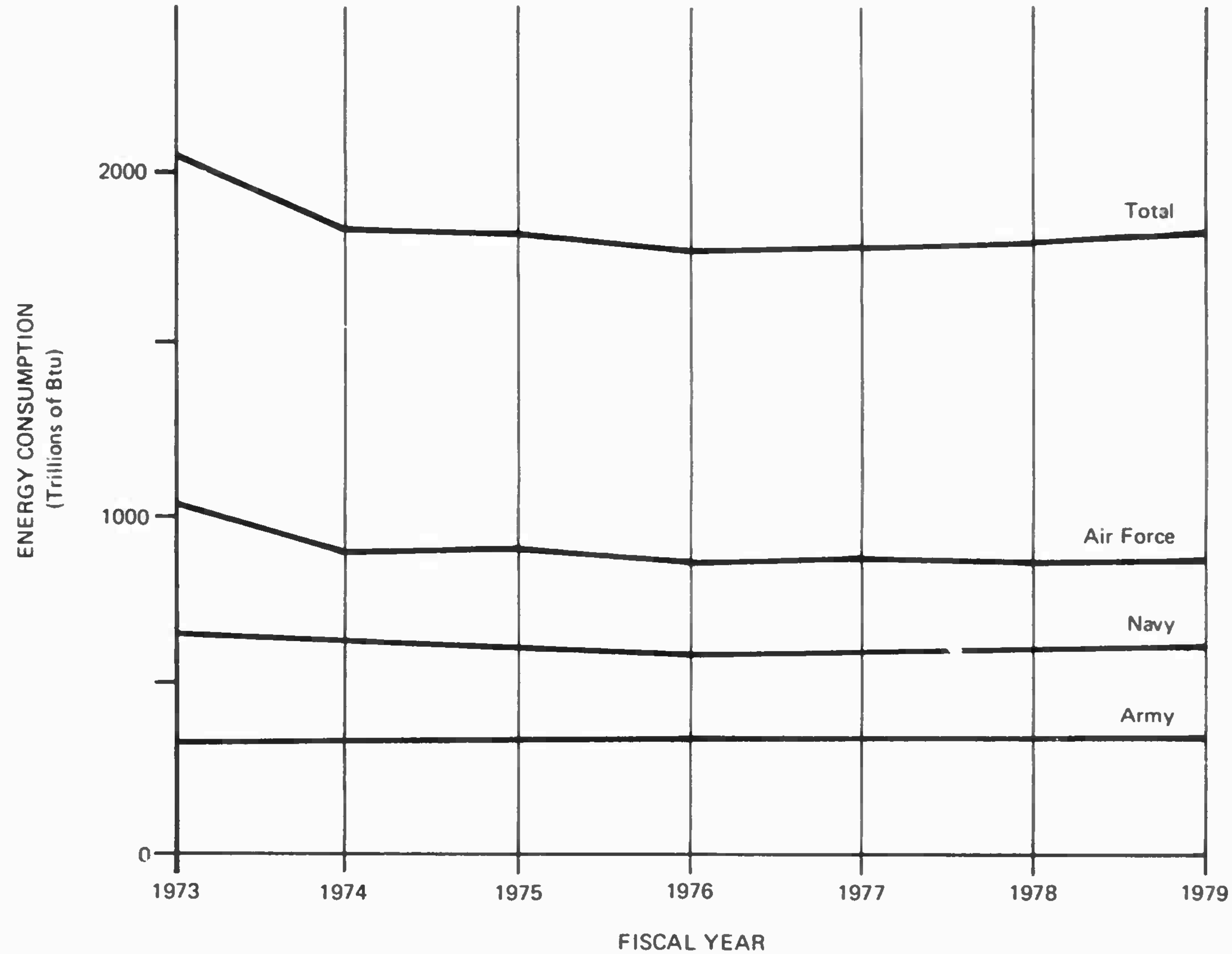


FIGURE 2-1. FORECAST OF ENERGY CONSUMPTION BY MILITARY DEPARTMENTS (EXCLUDING NUCLEAR)

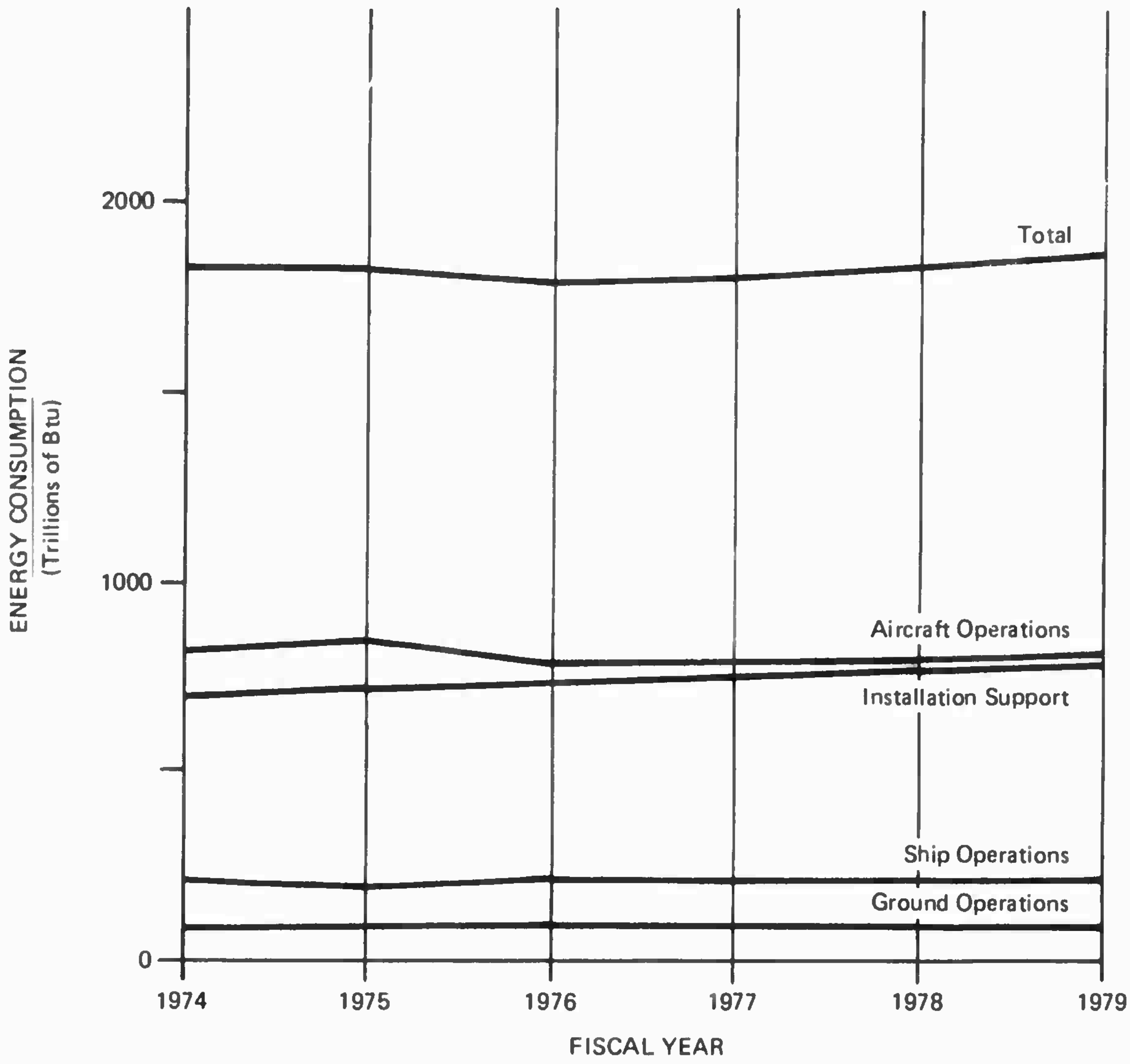


FIGURE 2-2. FORECAST OF ENERGY CONSUMPTION BY TYPE OF USE (EXCLUDING NUCLEAR)

Nevertheless, the use of energy in support of installations appears to be a fruitful area for making reductions through intelligent conservation measures.

Figure 2-2 shows that requirements for ship operations (excluding nuclear) will decrease from FY74 to FY75 as the ship inventory decreases and will increase slightly from FY75 to FY79 as new ships enter the fleet. Overall, there will be a slight decrease in energy requirements for ship operations from FY74 to FY79.

The requirements for ground operations will essentially remain constant throughout the period, with the Army being the major user. The Army also will be the major consumer of energy for installation support.

The requirements of each military department by type of operation are shown in Figures 2-3 to 2-5. Eighty percent of the Army's requirements (Figure 2-3) will be for installation support and about 12 percent for ground operations. In the Navy (Figure 2-4), installation support will be the primary consumer, about 28 percent, although ship and aircraft operations will also be major consumers. Aircraft operations will consume about 70 percent of the Air Force energy requirements (Figure 2-5), and installation support will account for about 26 percent.

Consumption of petroleum fuels will decrease approximately 3 percent from FY74 to FY79. Overall, the projected average consumption is approximately 232 million bbl/year. The decline in aircraft operations of approximately 6 million bbl will be partially offset by the increase in installation support of approximately 2 million bbl. The decrease in Air Force and Navy requirements will more than offset the slight increase in Army requirements.

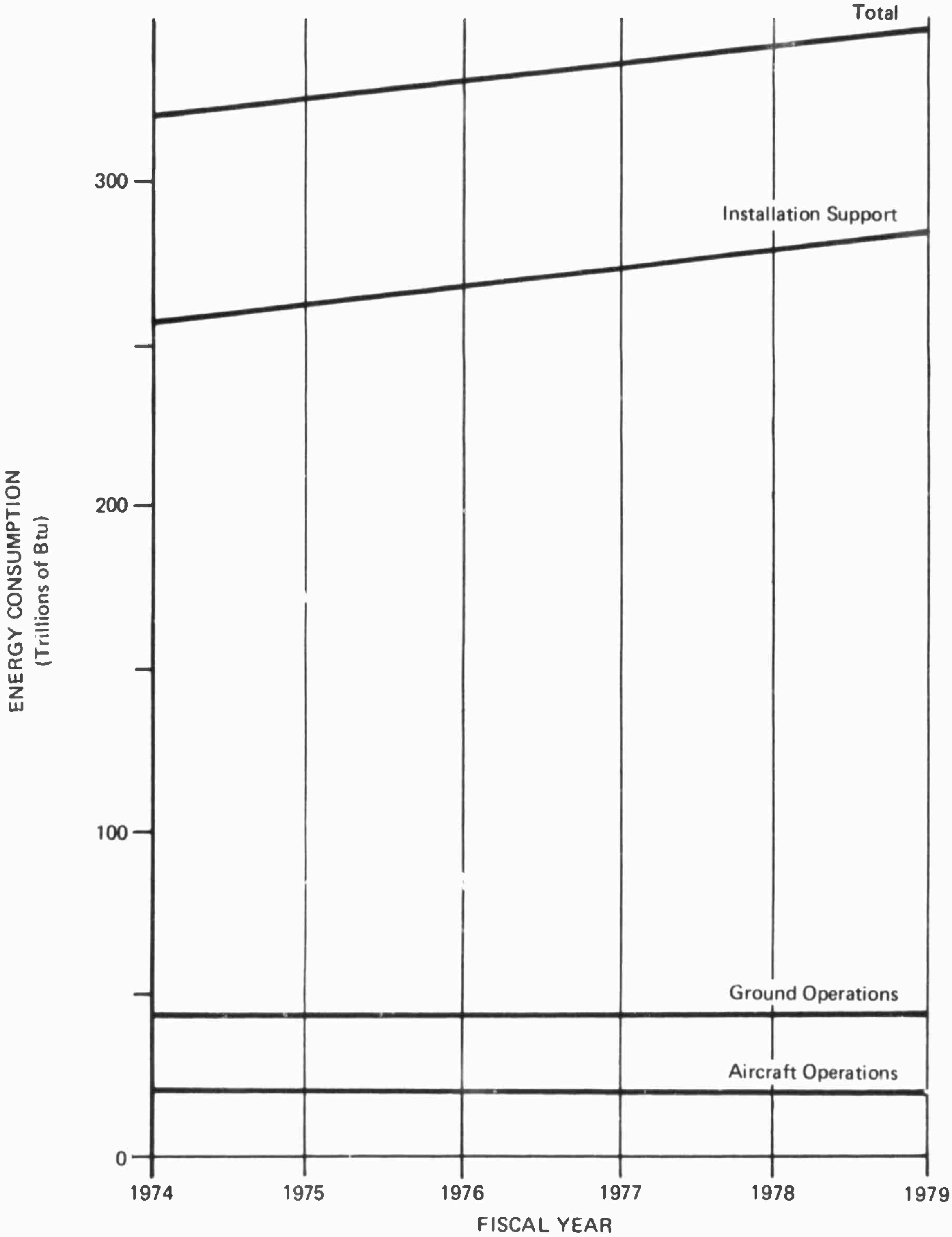


FIGURE 2-3. FORECAST OF ARMY ENERGY CONSUMPTION
BY TYPE OF USE
(EXCLUDING NUCLEAR)

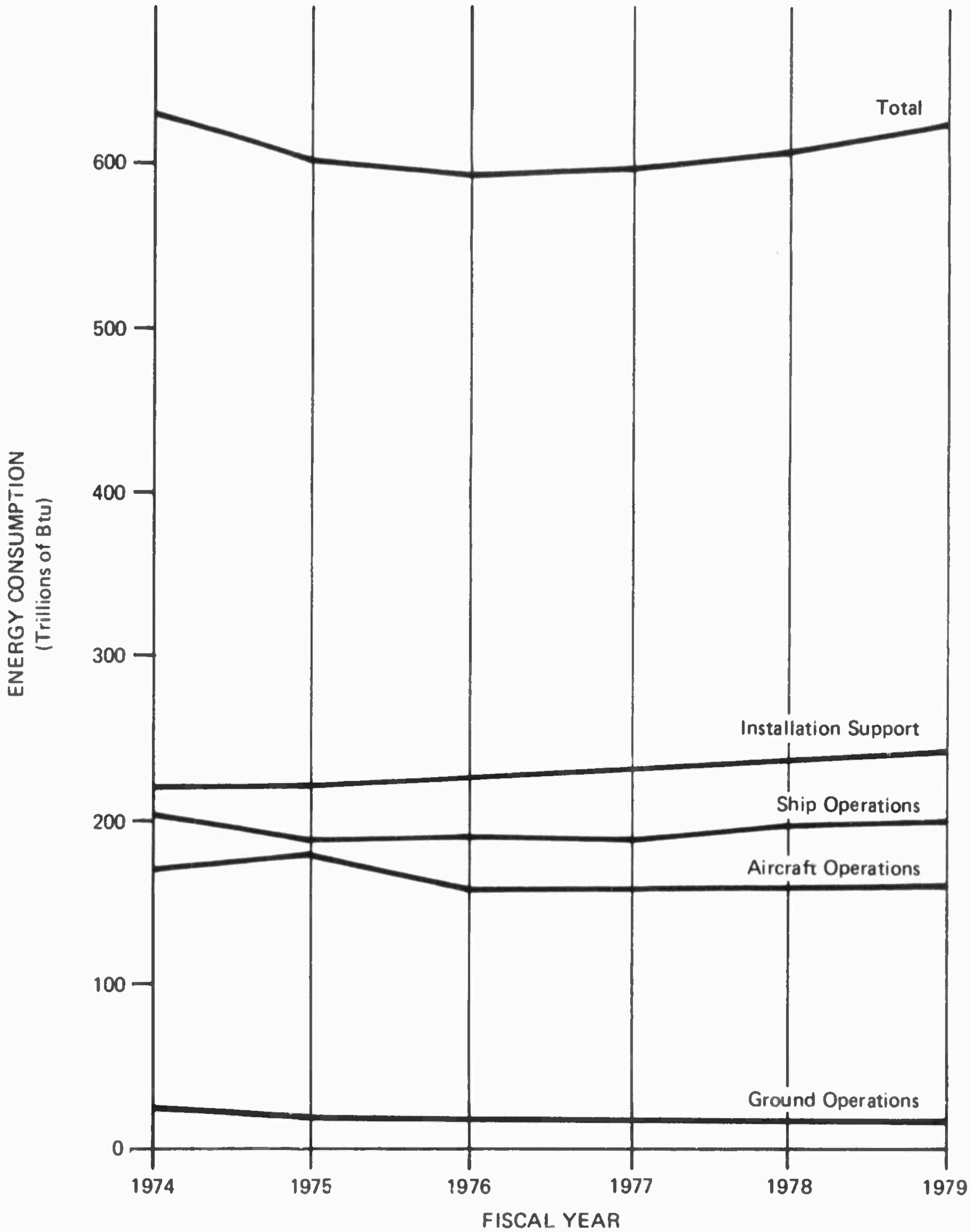


FIGURE 2-4. FORECAST OF NAVY ENERGY CONSUMPTION BY TYPE OF USE (EXCLUDING NUCLEAR)

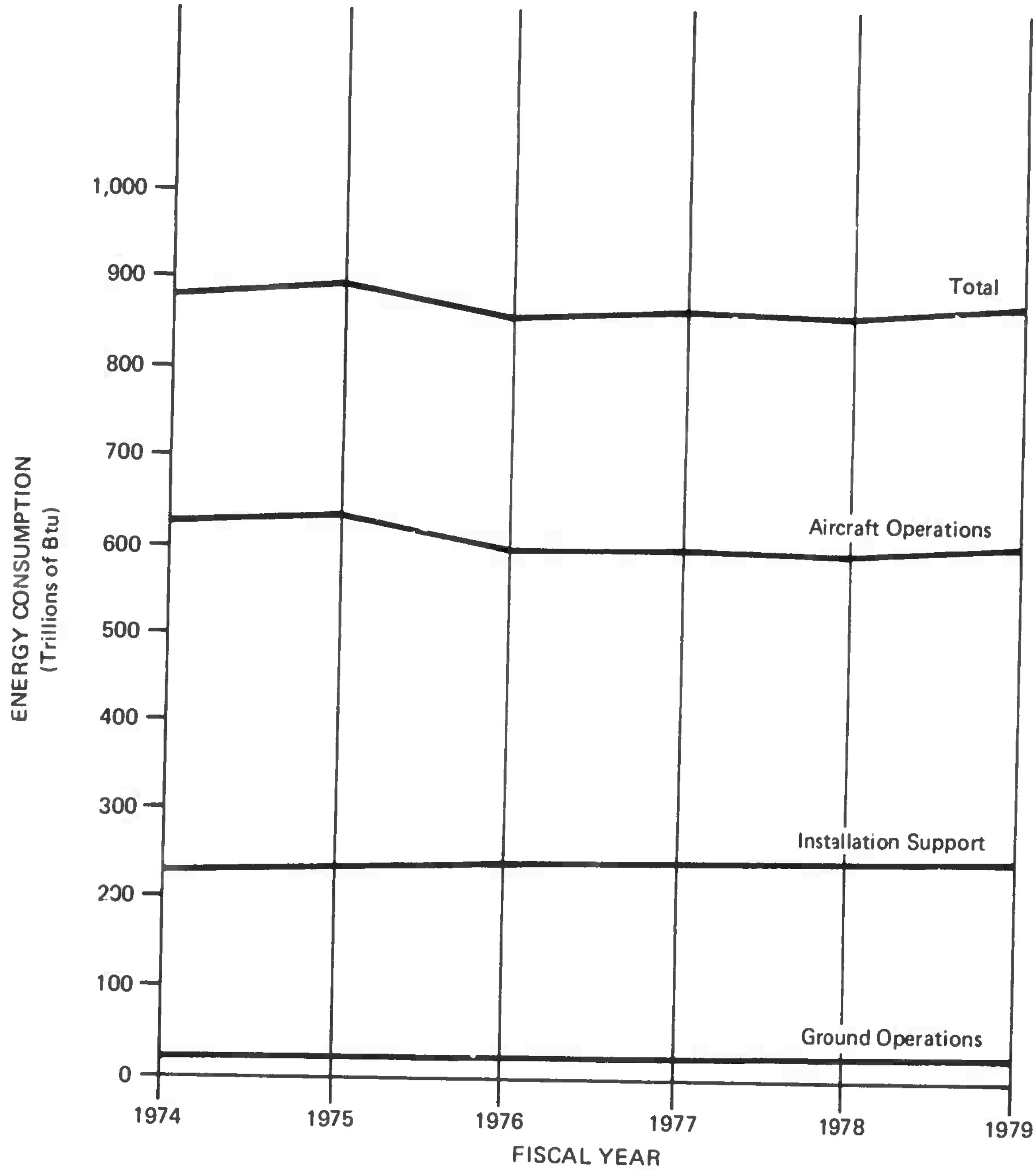


FIGURE 2-5. FORECAST OF AIR FORCE ENERGY CONSUMPTION BY TYPE OF USE (EXCLUDING NUCLEAR)

2.3 COMPARISON OF REQUIREMENTS WITH MATRIX II ESTIMATE

On 29 June 1973, the President established a nationwide goal of reducing expected energy demand by 5 percent during FY74. To set an example, he directed a goal of 7 percent for the Federal Government. The Department of the Interior (DOI) established a reporting system whereby each Federal agency would report its conservation strategy (Matrix I) and its FY73 baseline energy consumption (Matrix II) against which the 7 percent conservation goal for FY74 would be applied. DoD submitted a Matrix II report in September 1973 based on the use of data from established reporting procedures to the extent possible, utilizing approximations and best estimates where necessary. The difficulty in obtaining accurate data in the prescribed format was recognized, and by letter of 22 August 1973, the Under Secretary of the Interior authorized the Secretary of Defense to use "best estimates" with appropriate footnotes. An attempt was made to eliminate Southeast Asia-related consumption from the baseline to avoid taking credit for conservation that was previously reported by DoD in May 1973, prior to the President's directive of 29 June 1973.

It should be noted that since petroleum represents 72 percent of total DoD energy consumption, the 7 percent reduction in petroleum use from FY73, reported in May 1973, is equivalent to 5 percent overall. When combined with the President's directive 7 percent overall reduction, DoD is required to achieve a total reduction of 12 percent in energy use in FY74 as compared to FY73 consumption.

The nature of the data and method of compilation of data for Matrix II yielded a total energy baseline with an estimated accuracy of plus or minus 10 percent.

The projected DoD energy requirements contained in this report were subsequently obtained from the military departments in October 1973. These data are more accurate than Matrix II, but they contain significant uncertainties. Accuracy is probably plus or minus 5 percent. The DETG estimate is somewhat different from the Matrix II submission for the reasons shown in Table 2-6.

TABLE 2-6

PARAMETERS FOR INPUT TO MATRIX II AND DETG ESTIMATES OF ENERGY CONSUMPTION

Parameter	Matrix II	DETG
Operational Requirements	X	X
Installations (50 U.S. States)	X	X
Installations (Overseas)	-	X
DoD Agencies	X	Negl.[1]
Sales to Non-DoD Agencies	X	NA[2]

[1] Negligible.
[2] Not considered applicable.

The following data were computed to correlate the DETG estimated consumption for FY74 with the Matrix II baseline:

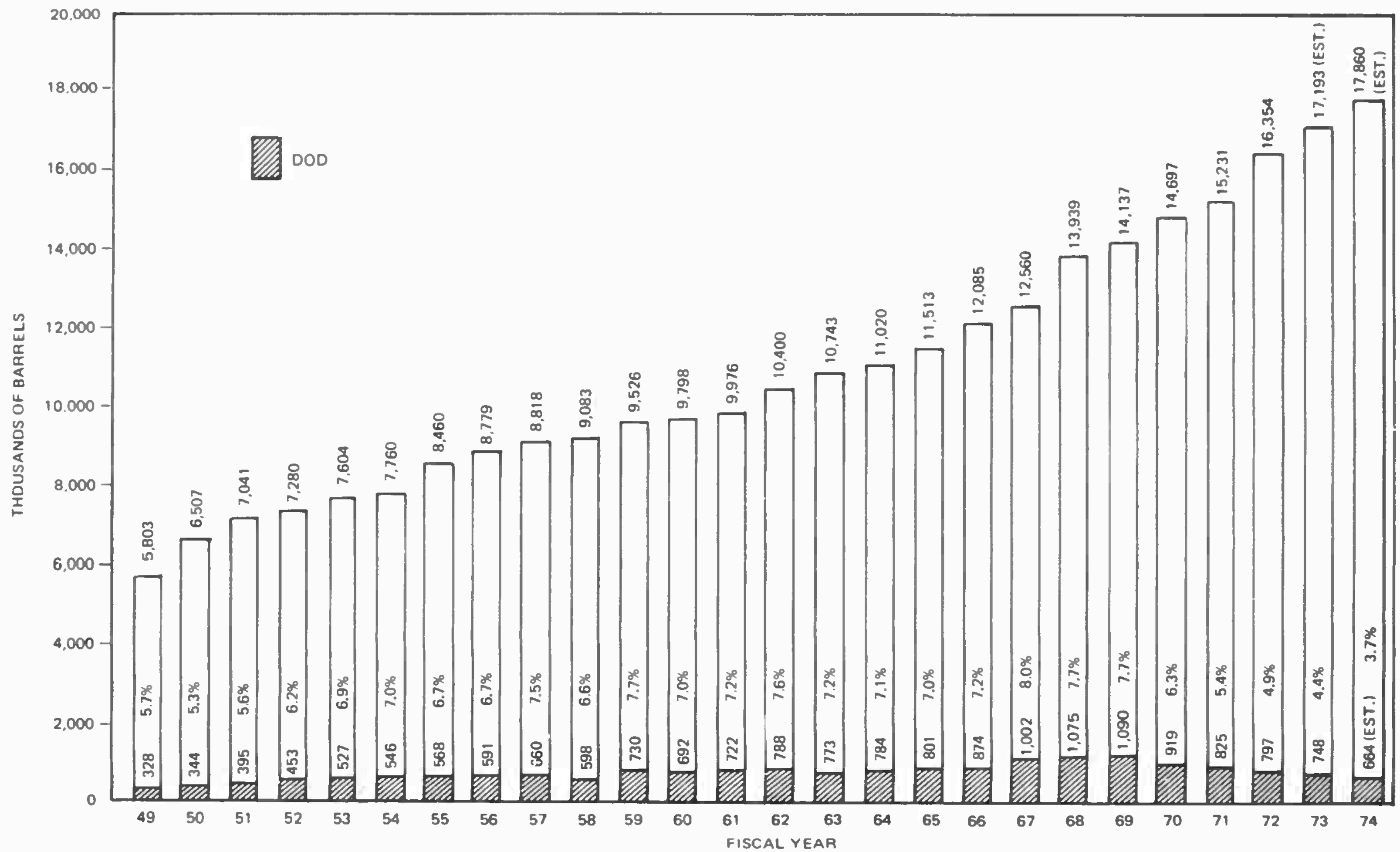
	Trillions of Btu
DETG estimated consumption for FY74---	1,828
Minus overseas requirements for installation support------------------	121
Subtotal	1,707
Plus estimate of energy consumption by DoD agencies other than the military departments------------------------	12
Plus sale of petroleum to non-DoD agencies---------------------------	92
DETG equivalent to Matrix II------------	1,811
Matrix II baseline published by DOI-------	1,930
93 percent of DOI Matrix II baseline------	1,795

The DETG equivalent to Matrix II (1,811 trillion Btu) is 6 percent less than the 1,930 trillion Btu contained in the DOI Matrix II, well within the ± 10 percent range of Matrix II values (1,737 trillion to 2,123 trillion Btu). Accordingly, the Matrix II baseline of 1,930 trillion Btu published by DOI should continue as the baseline for measuring the directed goal of a 7 percent reduction in consumption. The OSD has given DoD organizations this quantity as a total baseline. Moreover, the baseline is subject to adjustment on a quarterly basis if sufficient justification is presented. The Defense Energy Information System proposed in Chapter 8 should, when implemented, provide even more reliable and timely information for future projections and appraisals of conservation efforts.

2.4 IMPACT OF DOD REQUIREMENTS ON TOTAL MARKET

As noted in Section 2.2, the Department of Defense consumes about 2.4 percent of the total U.S. energy demand, which is about 85 percent of the total Federal Government energy consumption. Petroleum-derived energy accounts for approximately 72 percent of DoD direct energy usage. As the impact of DoD energy consumption for other than petroleum is relatively insignificant, this analysis will emphasize petroleum energy.

Historically, the DoD worldwide petroleum consumption expressed as a percentage of the total annual U.S. petroleum consumption has remained relatively constant for the last 25 years, ranging from 5.7 percent in FY49 to 7.7 percent in FY69, during the peak consumption period of Southeast Asian operations. The percent increase resulting from the Korean War was minimal and represented minor phase-ins of high energy consuming jet aircraft into the military inventory. The DoD part of U.S. petroleum consumption held fairly constant at about 7 percent from FY54 to FY69. A decline began in FY70, and the DoD share has decreased ever since, reaching a low of 4.4 percent in FY73 and an estimated 3.7 percent in FY74 (see Figure 2-6). Approximately 50 percent of the total DoD petroleum supplies during the Vietnam era was obtained from foreign sources. This foreign procurement effectively reduced that portion for which DoD was in direct competition with U.S. consumption to approximately 3.9 percent during FY68. The fraction of product procured from foreign sources has remained close to 50 percent since that time (see Table 2-7). However, recent actions by Arab nations to restrict sales to the United States could drastically alter this situation if continued.



SOURCE: U.S. DAILY DEMAND - API PETROLEUM FACTS & FIGURES
DOD DAILY DEMAND - DFSC HISTORICAL DATA.

FIGURE 2-6. PETROLEUM PRODUCTS CONSUMPTION—U.S. AND DOD DAILY AVERAGES, FY49 TO FY74

TABLE 2-7

SOURCE OF DOD PETROLEUM PRODUCTS
(Based on FY73 Procurement Awards)*

Source of Product	Barrels (in Millions)	Percent of Total
CONUS Alaska Hawaii	166.6	50.0
Middle East	49.6	14.9
Caribbean	31.0	9.3
Singapore	25.3	7.6
Other Pacific	34.7	10.4
Europe and Mediterranean	24.7	7.4
Other	1.3	0.4
	333.2	100.0

*Actual deliveries against contract awards were 243 million bbl. Fractional deliveries from each contract were approximately equal, so relative percentages will have little if any variation. Actual figures on basis of deliveries by source are not part of the current reporting system and are not available.

In contrast to the fact that most of the DoD petroleum energy requirements for American Forces stationed overseas came from foreign sources, the coal consumed by U.S. forces stationed in Europe originated in the United States. This coal usage amounted to approximately 1 million tons in FY72, 600,000 tons in FY73 (when the winter was mild and many conversions to oil were completed), and is projected at 750,000 tons for FY74 (when reversions to coal are being effected). Expenditures for this energy form approximately $34 million, $21 million, and $27 million in FY72, FY 73, and FY74 respectively.

For FY73, direct DoD competition with the civilian sector for petroleum represented about 2.2 percent of total demand in the United States. This figure was projected to decline to 1.9 percent in FY74, prior to the denial of sales by the Arabs in October 1973. When military jet fuels (JP-4 and JP-5) are considered alone, the ratio of DoD consumption to total U.S. demand presents a different picture. JP-4 is a naphtha base fuel used almost exclusively by the Air Force. Based on FY72 figures, the latest available for a full year, a total of 45 percent of the JP-4 requirement was procured overseas. The 87 million bbl procured in the United States represented 98 percent of the U.S. JP-4 production at that time. Although JP-4 does not compete with demand for commercial jet fuels, it is competitive with gasoline and the petrochemical industry for naphtha feedstocks. JP-5 is a kerosene base product, and is directly competitive with the jet fuel produced for commercial airline use. The 16.8 million bbl of JP-5 procured in the United States in FY72 represented only 5.7 percent of the total U.S. demand for kerosene base jet fuel. Military demand in CONUS for JP-4 and JP-5 combined is 27 percent of the total U.S. demand for jet fuels.

It is anticipated that DoD petroleum fuels requirements will remain at about the present level of 652,000 bbl/day. Because of the worldwide fuel shortage, increasing prices, and the national program to develop conservation practices, the rate of increase in total U.S. energy consumption may diminish. Nonetheless, the amount of petroleum DoD will use when stated as a percentage of total U.S. demand is expected to continue its downward trend. In the event that troops, dependents, and associated equipment stationed overseas are relocated to CONUS, it is possible that consumption of energy from U.S. sources may increase as a percentage of the total U.S. consumption. Continued embargo of sales to the United States by Arab countries may drastically alter this situation.

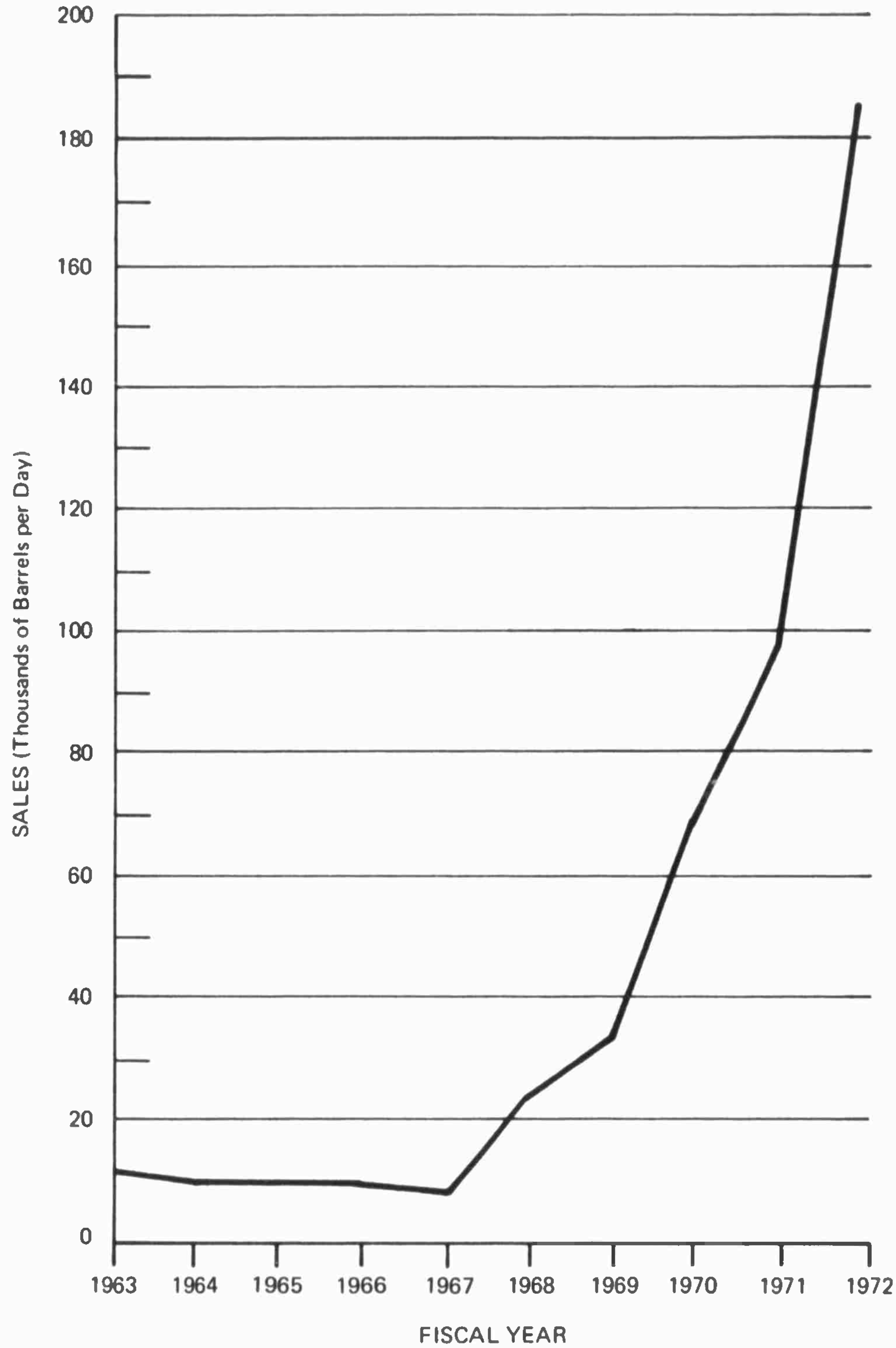
An analysis of historical data on petroleum requirements during World War II and the Korean War and Vietnam conflict indicates wartime consumption in relation to the total U.S. energy petroleum demand varies with the events. During World War II, total war consumption of oil and its products (excluding Russia and the Axis Powers) was 1.9 billion bbl, or somewhat more than one-fourth of oil production during the war (Ref. 1). Peak World War II petroleum consumption occurred in FY45. In that year, 570 million bbl were consumed in the war effort and represented less than 10 percent of the petroleum used by the United States in 1972 (Ref. 2). During

the peak of activity in Vietnam, in 1969, military consumption approximated 1.1 million bbl or 7.6 percent of the total U.S. consumption at that time. By comparison, in 1972, the consumption of gasoline in the United States averaged 6.4 million bbl daily, or 39 percent of the total 16.4 million bbl of petroleum consumed daily in the United States (Ref. 3). A reduction of approximately 25 percent of the current vehicular consumption would make available the estimated 1.6 million bbl required worldwide each day by the military for a major war. Continued embargo on the sale of crude oil and refined product to the United States by Arab countries could cause a more serious impact on the civilian market to meet military requirements in wartime.

2.5 AVAILABILITY OF ENERGY TO MEET DOD REQUIREMENTS

The inexpensive energy resources that have made possible so much of U.S. national growth are not continuing to be developed sufficiently to meet constantly increasing demands. In the near term, the nation is facing a difficult and serious energy supply shortage. Supplies of natural gas are decreasing. Industry in general and utilities (see Figure 2-7) in particular are converting to fuel oil, which is already in short supply, to comply with clean air standards. A shortage of electrical generating capacity increases the probability of future brownouts in major population areas. Supplies of propane and natural gas are critically short in many areas, and outages are anticipated. Alternate sources of fuel or energy are necessary. The statutory clean air regulations mean higher fuel costs and major supply problems.

For the very near term, the peacetime supply of fuel for DoD is critical. The Defense Fuel Supply Center (DFSC) has not been able to obtain full contractual coverage of the military requirements for the first half of FY74. Deficiencies in availability of jet fuel is a major concern. Fuel oil supply is critical, and spot shortages exist in many areas. The recent embargo on sales to Western countries has dramatically increased the criticality of the supply situation. DoD does not maintain terminal stocks of ground products for distribution to CONUS installations, so contract shortages in such products as motor gasoline and heating fuels are promptly felt at the installation level. The Defense Fuel Supply Center, the military departments, and the Joint Chiefs of Staff (JCS) are exploring ways and means for the priority allocation of available fuel supplies on the premise that serious supply shortfalls will



Source: U.S. Bureau of Mines.

FIGURE 2-7. SALES OF DISTILLATE FUEL OIL TO PUBLIC ELECTRIC UTILITIES, 1963 TO 1972

develop. The problem is complex, involving the establishment of priorities between installations of a single department or of two or more departments, possible use of prepositioned war reserve stocks to maintain essential operations, uneconomic and costly redistribution of available products, and distribution capability. The potential for a combination of unseasonably cold weather and shortfall of supplies in some locations is exceedingly high. Should this occur, available DFSC stock is insufficient to meet demands. Entire installations or major portions of their facilities may have to operate without adequate heating and sustain serious damage to temperature-sensitive equipment. Operations and training will of necessity be significantly reduced or transferred to bases that require less energy for the winter operations. Prior to the recent embargo, less difficulty was encountered in procurement for forces stationed overseas, since fuel for these forces was largely obtained from foreign sources.

As noted in Chapter 1, a serious short supply of energy will exist for some time, and the United States will depend heavily on imports of foreign crude oil and refined products into the next decade. Government policies can accelerate or reverse adverse trends in the U.S. energy supply situation and will be a crucial determinant of the long-range energy position of the United States. Experience has shown that during the recent price freeze, DoD was unable to obtain adequate products on the open market. Under price freeze rules, the Government could not compete for available products. With the advent of Phase III in July 1973, 27 suppliers, servicing 95 installations, notified DFSC they would not deliver at the freeze price. This placed the contract coverage deficit for July at 45 and 59 percent for JP-4 and JP-5 respectively. In October 1973, the CONUS contract coverage of JP-4 and JP-5 domestic requirements was still short 15 and 27 percent respectively (see Figures 2-8 and 2-9). Continued inability to obtain firm contract coverage under Phase IV caused DoD to request the Secretary of the Interior to invoke the Defense Production Act to ensure that an adequate share of petroleum fuels is available to DoD. The invocation was approved on 1 November 1973. The effects are yet to be seen. It is assumed that in wartime, necessary rationing and other essential controls will be implemented to ensure availability in increased quantities.

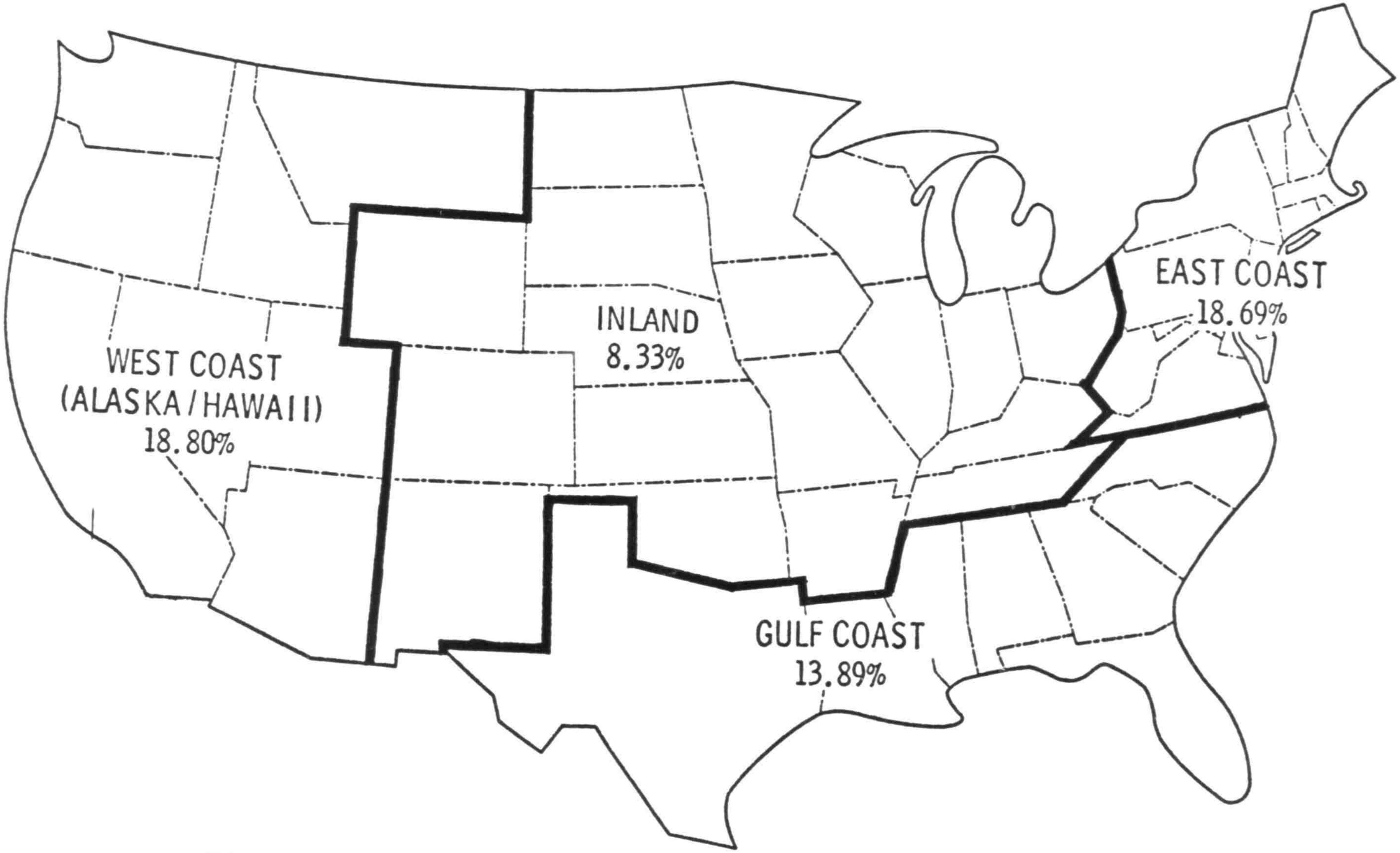


FIGURE 2-8. JP-4 JET FUEL SHORTAGES, JULY TO DECEMBER 1973
(Percentage of Requirements Uncovered)

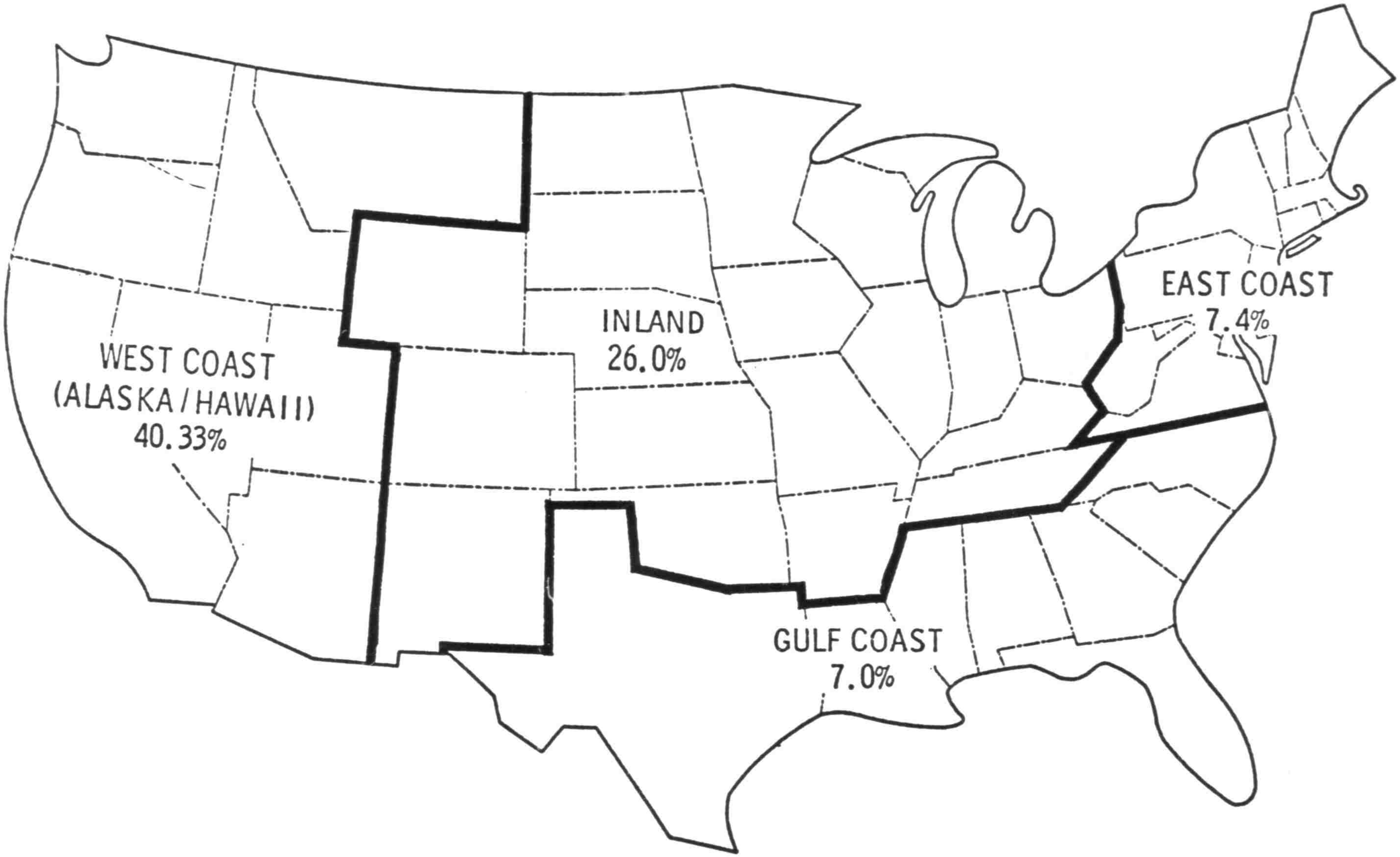


FIGURE 2-9. JP-5 JET FUEL SHORTAGES, JULY TO DECEMBER 1973
(Percentage of Requirements Uncovered)

2.6 IMPACT OF RISING PRICES ON DOD BUDGET

Energy prices are rising and are predicted to continue to rise until supply and demand eventually balance. At present, it is not practicable to forecast when a time of supply equilibrium or stable prices will occur. The demand for petroleum products, like food, appears to be inelastic over a wide price range. Historically, prices of petroleum products have lagged behind normal increases in other commodities. At the end of July 1973, the crude oil price index was 127.6, whereas the wholesale price index was 142.8 (see Figure 2-10). In April 1973, DFSC projected an FY74 increase of 32 percent for military petroleum products. The FY74 stock fund budget was increased by about $300,000,000, and standard prices were increased accordingly to avoid a deficit. This projection was based on industry responses to Invitations for Bids covering contracts for the period 1 July to 31 December 1973 for jet fuels in CONUS and overseas, and on impending price increases by the Organization of Petroleum Exporting Countries (OPEC). Increases for bulletin contracts for support of posts, camps, and stations were comparable. Since the original projections were made, crude oil prices on the world market have continued to increase. The dynamic nature of the world petroleum situation makes any projection of cost increases a controversial subject. Historical data are of little value in estimating near-term and future petroleum prices. Projections must consider the very recent market situation, actions of OPEC, world tanker rates, the recent Arab-Israeli conflict, and other impending actions. As a result of the Arab embargo, worldwide competition for available product will further intensify. In light of these factors, it is believed that the original projection of a 32 percent increase made by DFSC in April 1973 was too low. An additional 10 percent increase in cost for FY74 is probable. Though world conditions preclude a firm projection, petroleum prices in FY75 could be 30 percent higher than the midyear FY74 prices. As petroleum products represent approximately 72 percent of the DoD energy consumption, price increases in petroleum will have the greatest impact on the budget. It is estimated that price increases of other forms of energy will approximate 10 to 15 percent/year. These price increases reflect normal inflation, the prime interest rate, impact of environmental improvement costs, fuel price increases for electrical and steam generation, and increased prices for natural gas.

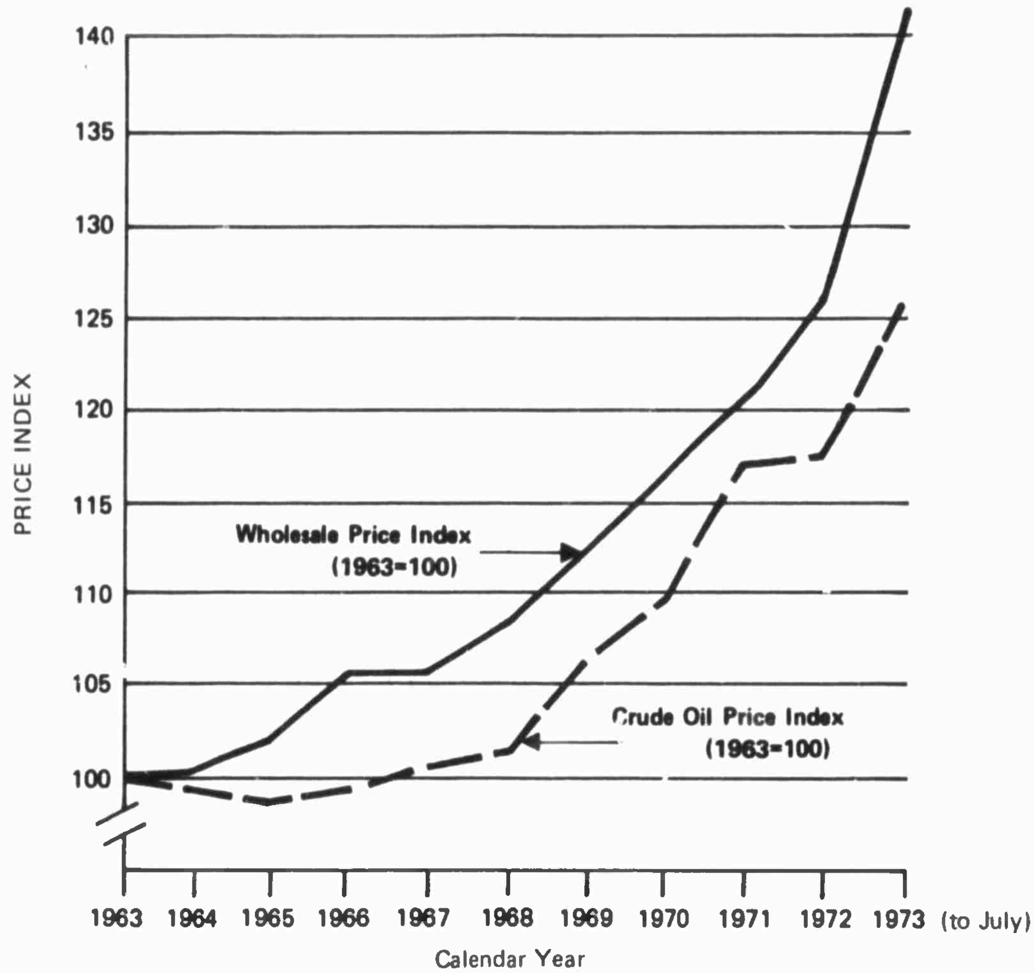


FIGURE 2-10. CRUDE OIL PRICE INDEX VERSUS WHOLESALE PRICE INDEX, 1963 to 1973

The cost of energy in the DoD budget is reflected under many programs and in diverse ways. There is fair visibility of utilities and POL costs "after the fact." However, there was no single source in any Service which could provide budget data on total energy costs. Because of this inability of the Services or current budget data to provide the information, it was necessary to construct an FY74 DoD energy cost baseline for purposes of this report by collecting data from many sources. It does not purport to be an accurate or complete energy cost analysis. Rather, it was developed to illustrate the cumulative effect of potential price increases in FY74 and FY75 on DoD energy costs (see Table 2-8).

Based on this energy cost analysis, the FY74 cost of petroleum products is about $2 billion, and the cost of other energy forms, commonly referred to as "utilities," is about $0.5 billion. Adjusting for the 7 percent savings resulting from ongoing conservation actions and the anticipated 10 percent cost increase, the increase over this DoD baseline would be about $48.2 million for petroleum and $14.8 million for utilities. Considering projected cost increases of 30 percent for petroleum and 12 to 15 percent for utilities, the FY75 increase from the revised FY74 baseline would approximate an additional $618.1 million and $67.9 million in those categories. This amount of increase approximates an average of 26.7 percent overall from the revised FY74 baseline to FY75.

2.7 CONCLUSIONS

2.7.1 Requirements

- The energy demand of the Department of Defense is estimated to remain relatively constant at about 1,800 trillion Btu/year during the FY74 to FY79 period.

- The relative size of demand for total energy and petroleum fuels, in descending order, is for aircraft operations, installation support, ship operations, and ground operations.

- Energy demand for installation support is rising while demand for aircraft operations is dropping, so that by FY79 each will represent about 42 percent of total demand.

TABLE 2-8

BEST ESTIMATE OF DOD ENERGY COSTS (FY74 AND FY75)
(Millions of Dollars)

Energy	Current FY74[1] Program	DETG FY74[2] Est	FY75 Est[3]
Petroleum			
DFSC Petroleum Fuels Stock Fund	1,583.0	1,619.0	2,105.2
DFSC Petroleum Packaged Products Stock Fund	26.0	26.6	34.6
DFSC Contractual Services in Support of Petroleum Distribution and Storage	11.0	13.2	17.2
DFSC Petroleum Fuels Procurement for Posts Camps, and Stations	390.5	399.5	519.8
Subtotal	2,010.5	2,058.7	2,676.8
Utilities			
Natural Gas and Propane	67.9	72.9	87.5
Coal	72.6	74.3	83.9
Electricity	353.9	362.0	405.4
Purchased Steam and Hot Water	2.1	2.1	2.4
Subtotal	496.5	511.3	579.2
Total Energy Cost	2,507.0	2,570.0[4]	3,256.0[5]

[1]Constructed from information provided by the Services and DFSC; includes 32 percent increase for POL.

[2]Increased to reflect probable average price increases during the fiscal year less 7 percent conservation savings for each energy form.

[3]Estimated cost reflecting probable average price increase for FY75.

[4]Increase of 2.5 percent considered conservative estimate considering world situation and potential impact on product availability and prices.

[5]Increase of 26.7 percent considered to be conservative estimate of price increases for FY75.

- Requirements data contained in this report are believed to be somewhat more reliable than similar figures reported to DOI in Matrix II, but they are still subject to further refinement.

- The total DoD conservation goal for FY74 as compared to FY73 use is, in effect, 12 percent (not 7 percent), and DETG projections indicate a good probability of achieving it if a vigorous conservation program is carried out.

2.7.2 Impact of DoD Requirements on Total Market

- Currently the DoD worldwide energy demand is 2.4 percent of U.S. demand. DoD worldwide petroleum energy demand is about 3.7 percent of total U.S. demand in FY74 and should continue to decrease. The DoD jet fuel demand within CONUS is about 27 percent of total U.S. production.

- In the event of a major war the DoD petroleum energy demand would be about 1.6 million bbl/day, or less than 10 percent of the projected 1973 U.S. daily consumption.

- A continued denial of petroleum from the Middle East could result in a serious loss of product availability to the United States from international suppliers. This would place more of the DoD requirements in direct competition with the U.S. civilian market.

2.7.3 Availability of Energy To Meet DoD Requirements

- Under peacetime controlled price conditions, as experienced with Phase III and Phase IV controls, DoD cannot be assured of adequate petroleum energy supplies on the open market.

- In wartime, implementation of rationing and other essential controls and priorities will provide adequate energy from Western Hemisphere sources to meet DoD requirements.

- A procedure for peacetime allocation of energy to DoD is necessary to ensure an adequate supply under shortage conditions.

- A procedure for allocating energy resources within and among the military departments is necessary.

- The DoD energy reporting and budget procedures do not provide adequate centralized management data for petroleum and other energy resources consumed by DoD.

2.7.4 Impact of Rising Prices on DoD Budget

- The world petroleum market is undergoing dynamic changes that preclude any reliance on historical data for projecting prices or availability.

- Projected price increases will add about $63 million to the DoD energy baseline budget in FY74 ($48 million for petroleum and $15 million for utilities). An additional $686 million cost is probable in FY75 ($618 million for petroleum and $68 million for utilities). The FY74 figure is a net increase even after application of the 7 percent planned reduction in use.

2.8 RECOMMENDATIONS

2-1. The Department of Defense should continue to use the Matrix II baseline to report progress to the Department of the Interior under the Presidential conservation program.

2-2. The Assistant Secretary of Defense (Installations and Logistics) should develop improved energy data reporting procedures to provide better visibility to the total DoD energy requirements and its cost.

2-3. The Assistant Secretary of Defense (Comptroller) should be prepared for an escalation of Operations and Maintenance (O&M) expenditures in FY74 owing to projected increases in the price of energy.

2-4. The Assistant Secretary of Defense (Comptroller) should adjust the FY75 budget and out year programs to reflect current projections of rising energy costs for utilities as well as POL.

CHAPTER 3

PETROLEUM STORAGE AND DISTRIBUTION

3.1 INTRODUCTION

This chapter is organized into four major sections that discuss the adequacy of the DoD storage and distribution capabilities for petroleum with particular emphasis on the adequacy of self-sufficiency vis-a-vis commercial reliance. The first major section, 3.2, presents the general policy overview, followed by capability summaries, conclusions, and recommendations. A specific analysis of the storage and distribution systems in support of contingencies is contained in the classified supplement (Chapter 9) of this report.

3.2 GENERAL POLICY OVERVIEW

Except where the criticality or essentiality of the item or the mission of the activity would otherwise indicate, the DoD peacetime distribution and storage policies (Ref. 1) follow the broad Federal guidance (Ref. 2) of reliance on private enterprise to supply its needs for product or services unless increased costs to the Government would result.

3.2.1 Storage

Responsibility for determining storage requirements for receiving operational supplies of fuel or for storing war reserves is spread among various components within DoD. Basically, each military department is responsible for determining its requirements and funding (through the military construction (MILCON) program) for the construction of petroleum facilities, including those needed for storage and distribution of products owned by the Defense Supply Agency (DSA) (Ref. 3). DSA provides continuing review of storage terminals and associated facilities. Joint reviews of storage requirements are required to be conducted by DSA with military departments and unified commands participating. Recommendations for acquisition, retention, and/or release of facilities are submitted by DSA to the military department, Joint Chiefs of Staff (JCS), unified command, and Office of the Secretary of Defense (OSD).

Long-range plans for MILCON among DoD overseas components are coordinated at the unified command level. The Defense Fuel Supply Center (DFSC) has the responsibility to contract for bulk commercial petroleum storage facilities required by the military departments. The principal determinants for petroleum storage facilities are the Peacetime Operating Stock (POS) and Prepositioned War Reserve Requirements (PWRR), with operational stock needs being satisfied first and PWRR being satisfied from the balance of available tankage.

Petroleum terminal facilities within CONUS have been used principally for storage of aviation fuels or ship propulsion fuels with little storage being required for heating and ground fuels (since support for these fuels has historically been from contractor source direct to consumer). After the supply support difficulties experienced during the 1972 to 1973 heating season (which required adoption of unique, lengthy, and costly distribution patterns), the Assistant Secretary of Defense (Installations and Logistics)ASD(I&L) issued guidance for activities to acquire additional on-base storage to preclude or minimize similar occurrences (Ref. 4). Although the revised policy required a minimum of 30 days' local storage and allowed for increased storage capacity (based on direct access to major distribution systems), no prepositioning policy for central terminal storage for heating fuels was addressed.

3.2.2 Distribution

The distribution of bulk petroleum, oil, and lubricants (POL) from commercial source to the initial Government facility (either terminal storage or an installation) is determined by conditions contained in the contract. These conditions are based primarily on the physical capabilities of the receiving activities and secondarily on the location of source and mode of transportation, with the latter determination almost exclusively based on economic evaluations (i.e., lowest laid-down costs to the Government). At posts, camps, and stations in the continental United States (CONUS), heating and ground fuels are generally furnished by local suppliers and distributors in small, frequent increments using commercial equipment. Supply is provided directly to various sites on the installations without any further redistribution. Thus, the need for substantial quantities of tankage in CONUS for heating and ground fuels until recently has been virtually nonexistent. DoD guidance generally discourages establishing safety levels for repetitive-demand consumable items at the installation level. For central distribution points, frequency, size, and reliability

of demand are considered in the determination of safety levels (which translate to storage requirements) (Ref. 5). With larger volumes required for aviation fuels, contracts may be awarded for deliveries into Government-owned and Government-used terminal facilities for subsequent redistribution to bases. Virtually all POL movements by tank truck within CONUS are in commercial vehicles. Transportation responsibilities are assigned to the Commander, Military Traffic Management and Terminal Service (MTMTS) (Ref. 6), who is responsible for furnishing Government or commercial tank cars, awarding contracts for transportation movements on inland waterways, and negotiating and approving common carrier rates (pipeline and truck) for movement of Government-owned POL in CONUS. Area management is executed by the five Defense Fuel Supply Center Field Offices (DFSCFO) which effect distribution of tonnage among approved carriers (Ref. 3). Responsibilities for land transportation in overseas areas are assigned to component commands by the unified commanders (Ref. 7).

When contracts are awarded for moving POL via ocean tanker to either storing or using locations, the Commander, Military Sealift Command (MSC), provides or otherwise arranges for tankers for movement of petroleum as requested by DFSC (Ref. 8).

3.3 STORAGE AND DISTRIBUTION REQUIREMENTS AND CAPABILITIES

3.3.1 Storage

In general, the criteria used for determining storage requirements are uniform among the military departments. The combination of POS and PWRR is increased by 10 percent to determine the storage required (Ref. 9). Prepositioned war reserve requirements are determined by each Service. Basic computations are made by multiplying the combat-intensity consumption rate by type and density of equipment (ship, aircraft, tanks) or manpower, and prestocking to sustain this computed rate for varying number of days, depending on the geographic area. POS levels are computed by the Services for installations and by DFSC for terminals (Ref. 3). Although overall POS should generally average 15 days of supply in CONUS and 30 days overseas, in actuality the POS varies considerably between locations (Ref. 3). Since POS is the quantity necessary to sustain operations between intervals of resupply, installations close to supply sources

receiving frequent small volume deliveries may have only 5 days' supply (the minimum established); whereas other installations, where resupply can be accomplished only during certain periods, may have as much as 13 months' supply (Ref. 3).

Petroleum storage facilities utilized by DoD agencies can be categorized into two major groupings: on-base facilities storing service-owned products needed primarily for the direct support of the installation mission, and terminal facilities storing DSA-owned products held for further redistribution to using activities. On-base facilities and inventories are under the management and control of the individual military departments. Management and control of terminal facilities depend on the type of facility and methods of operation. Government-operated terminals are managed and controlled by the military department operating the terminal. Contractor-operated terminals, both Government owned and commercially owned, are managed and controlled, through terms of the contract, by DSA or the military department to which the contracting authority has been delegated by DSA. Where DoD uses foreign government facilities (through bilateral or multilateral agreements, such as in NATO), the respective military department exercises management and operational control through its counterpart in the foreign government.

Annual reports of storage capabilities are required from each military department in accordance with DoD guidance (Ref. 3). Latest available data reflect total DoD worldwide storage capacity of 127.5 million bbl of serviceable tankage, excluding tankage within CONUS used for storage of ground products for local consumption. Table 3-1 displays DoD tankage assets by geographical locations. Of the 41.7 million bbl available in CONUS, 33.1 million bbl are owned and 8.6 million bbl are under lease. Overseas, of the 85.8 million bbl available, 56.6 million bbl are owned and 29.2 million bbl are under lease or otherwise available through bilateral or multilateral agreements (Ref. 10). DoD-owned and -leased tankage in CONUS, Alaska, and Hawaii represents 6.3 percent of the total U.S. capacity of 814.7 million bbl (excluding crude oil tankage) (Ref. 11).

TABLE 3-1

DOD PETROLEUM STORAGE ASSETS
(Thousands of Barrels)

Area	Owned	Leased	Total
ALCOM	4,092.0	0.0	4,092.0
LANTCOM	8,963.7	1,302.6	10,266.3
EUCOM	14,241.4	16,307.3	30,548.7
PACOM	26,302.6	11,599.1	37,901.7
SOUTHCOM	2,977.2	0.0	2,977.2
Subtotal Overseas	56,576.9	29,209.0	85,785.9
CONUS	33,068.6	8,599.9	41,688.5
Worldwide Total	89,645.5	37,808.9	127,454.4

Source: Report of Bulk Petroleum Storage Capacities, Volume I and II; RCS:DD(I&L)A 506,1972

Estimates of required storage for operational and war reserve requirements were calculated from the FY74 consumption forecast to obtain an average POS of 30 days, adding PWRR and computing the amount of storage required. Based on these calculations and using data contained in the report of bulk petroleum facilities, there is sufficient tankage worldwide to meet FY74 POS and PWRR (Refs. 12 and 13). Computed storage requirements, indicated as percentage of existing capacities, are listed on Table 3-2.

Table 3-2 indicates that sufficient gross storage capacity exists worldwide even when considered on the basis of major products. However, there is not enough available information to show how much of that tankage can be utilized effectively. The tankage may be geographically malpositioned. Also, tank farm configuration may be such that better utilization (e.g., storage of more than one type of product) cannot be accomplished. One further complicating factor that prevents full utilization of assets is the material condition of the facilities. Several major Government-owned terminals require extensive repair and rehabilitation. In the face of these unknowns, a detailed review of storage capabilities is warranted.

TABLE 3-2

FY74 STORAGE REQUIREMENTS* FOR 30 DAYS' POS PLUS PWRR

Product	Percent
JP-4	89.9
JP-5	70.5
Aviation Gasoline	26.7
Motor Gasoline	66.7
Diesel Fuels	62.3
NSF/NDF	44.9

*Expressed as percentage of existing capacity listed in 1972 report of storage facilities. Excludes tankage reported as EMPTY.

In response to the recent ASD(I&L) guidance, the military departments have identified additional on-base storage requirements to provide for 30 days of storage capability for heating fuel (based on the coldest period of the year). Net additional tankage requirements are 2,220,000 bbl, thereby increasing existing fuel oil tankage from 6,253,000 bbl to 8,473,000 bbl. The following are Service requirements: Navy—from 915,000 to 1,845,000 (Ref. 14), Air Force—from 4,251,000 to 4,713,000 (Ref. 15), and Army—from 1,087,000 to 1,915,000 (Ref. 16). Although implementation has been limited, the Services have submitted MILCON projects for this purpose totaling about $31 million.

The primary POL supply pattern for heating and ground operations has been by direct deliveries to military installations by small distributors and suppliers within the vicinity of the installation. With the tight supply situation, DFSC has had considerable difficulty in obtaining contracts to satisfy requirements. As of 4 October 1973, contract coverage to meet fuel requirements showed shortfalls ranging from 0.1 percent to 51.4 percent for different areas of CONUS (Ref. 18). These deficiencies are displayed in Table 3-3.

TABLE 3-3

ANNUAL FUEL SHORTAGES BY PROCUREMENT REGIONS FOR HEATING AND GROUND OPERATIONS AS OF 4 OCTOBER 1973
(Data in Barrels)

Area (Regions)	Gasoline	Distillates	Residuals
Northeast (1, 2, & 3)			
Shortage	921,429	854,762	26,190
Monthly Demand	192,857	604,563	743,849
Days Short	143	42	1
South (4)			
Shortage	47,619	142,857	107,143
Monthly Demand	137,500	220,635	142,460
Days Short	10	19	23
North Central (5 & 6)			
Shortage	100,000	464,286	21,429
Monthly Demand	140,278	326,587	91,270
Days Short	21	43	7
West (7 & 8)			
Shortage	558,714	876,191	73,809
Monthly Demand	145,040	268,254	80,754
Days Short	116	98	27
CONUS Total			
Shortage	1,627,762	2,338,096	228,571
Monthly Demand	615,675	1,420,039	1,058,333
Days Short	79	49	6

Note: Monthly demand estimated at one-twelfth of annual procurement requirement. No adjustments made for seasonal variations in demand.

Since the predominant factor contributing to the lack of coverage for these fuels is the scarcity of supply for the local distributors and suppliers who had previously filled requirements, full coverage cannot be predicted even with mandatory allocations that have been imposed. Although this type of program distributes shortages for heating fuels equitably among consumers in a priority sequence, the criticality and military essentiality of some bases experiencing shortfalls may be of more significance than others. Even though the increased storage capacity directed by ASD(I&L) was to preclude disruption of fuel supplies by allowing bases to achieve inventory build-up during summer months, the lack of supplies has also hampered implementation of the plan.

One approach to meet these requirements would be to site selectively central distribution facilities for satisfying requirements at posts, camps, and stations. The concept of the central distribution facility for ground fuel support of installations has generally been discouraged both by policy guidance and by procurement methods (Ref. 1). However, 36 aviation fuel terminal facilities have been utilized to meet peacetime operations whenever the procurement evaluation indicated indirect support of installations (through a terminal rather than direct from supplier to user) was more economical. This system permitted procurements in larger volumes and usually at more advantageous prices. Since a system for management (by the Defense Fuel Supply Center Field Offices) of this supply method currently exists (Ref. 3), the treatment of ground and heating fuel support by this method would entail adding about four additional terminals to cope with currently identified shortages. To provide for this central distribution system for ground fuels, several actions are necessary, none of which requires major policy revisions. These actions include modification of the procurement policy currently used for posts, camps, and stations support; acquisition of terminal storage facilities for use as central distribution points, thereby changing the pattern of reliance on commercial enterprise; and increasing budgetary and manpower authorizations as required. Since the most responsive method for immediate acquisition of terminal facilities is through contracts negotiated by DFSC, acquisition of terminal facilities through long-term contracts can be attempted. Construction by industry for exclusive use by DoD with options for DoD purchase can also be explored if existing facilities are not readily available.

Funding for terminals used exclusively for ground fuels may require a modification to the existing DSA Stock Fund charter (Ref. 3). The selective siting of terminals to meet requirements should be determined by DFSC based on a review of the requirements submitted by military installations. Since DFSC has the single procurement responsibility for POL, military departments will have to ensure that all requirements are furnished in sufficient time to canvass industry to ascertain the availability of the required facilities. In determining areas where facilities are required, the transportation concept now employed for redistribution of aviation fuel from terminals to bases should be employed. For supply of the terminals, pipeline connections or access by water generally are more cost effective and allow for opportune spot procurements. Filling of tankage may even be accomplished by procurement of fuel from offshore locations provided the terminals are accessible from port locations.

Costs for leasing of commercial facilities are on an upward trend. The average cost in FY73 was $0.54 per barrel of storage, including usage (throughput) charges. Preliminary estimates for FY74, based on new contracts, are $1.00 per barrel. Provided selective siting of facilities can be made and the facilities can meet heating fuel shortages for installations, it may prove more economical to lease tankage and obtain volume buys of product to meet heating fuel requirements for the next 3- to 5-year period in lieu of constructing additional on-base facilities, except in isolated instances. An economic analysis will be necessary to determine whether acquisition should be through lease arrangements or through MILCON programs.

3.3.2 Distribution

The distribution of DoD-required petroleum products in bulk form encompasses two main transportation areas:

- Ocean transportation—tankers
- Land transportation—rail tank car, tank truck, inland barges, and pipeline.

3.3.2.1 Ocean Transportation

Ocean tankers are generally the most economical means of transporting large quantities of fuel from refinery or storage to destination. Since 1967 ocean transportation has accounted for more than 50 percent of DoD transportation of fuel. Of the total movement of DoD fuel by ocean tankers, 73.5 percent is for overseas destinations (Ref. 19). Denial of this mode, by interdiction of sea lanes or through lack of tanker capability, will virtually eliminate provisions of fuel to overseas activities and seriously impact on support of CONUS activities.

The Military Sealift Command (MSC) maintains a controlled tanker fleet dedicated to DoD bulk petroleum transportation. This fleet is divided into two segments:

- Government-owned tankers (U.S. Naval Ships).
- Privately owned tankers under long-term charter (lease). These charters are usually for a maximum period of 5 years with MSC options for renewal for further charter.

The size determination of this fleet depends on the DoD forecasted, or immediate, requirements for bulk petroleum movement via MSC tanker. This fluctuation in fleet size to meet requirements is apparent in Table 3-4, which contrasts the fleet compositions as of 1 October 1973 and 1 July 1968 (highpoint Southeast Asia).

The size of the Government-owned (nucleus) tanker segment is determined by legal, policy, and budgetary factors. Legal and policy constraints are basically designed to avoid competition with the private U.S. merchant marine fleet and to ensure the development of a privately owned and operated fleet without military control. There is an ongoing concern for developing a privately owned U.S. flag merchant fleet, as reflected by the October 1973 Report of the Commission on American Shipbuilding with its specific recommendations for maintaining a strong merchant marine "which is dependent on its capability to secure and carry an adequate amount of cargo at a reasonable profit" (Ref. 20).

TABLE 3-4

MSC-CONTROLLED TANKER FLEET COMPOSITION*
AS OF 1 JULY 1968 AND 1 OCTOBER 1973

Category	No. of Ships		Capacity (Thousands of DWT)		T-2 Equivalent*	
	1968	1973	1968	1973	1968	1973
U.S. Naval Ships	27	17	410	287	26	17.4
U.S. Flag Charter	48	27	1495	821	102	54.8
Foreign Flag Charter	27	2	600	57	39	3.9
Total	102	46	2505	1165	167	76.1

*T-2 equivalent is a common international standard (notional ship) for measuring total tanker requirements. The standard World War II built T-2 tanker had a capacity of 16,500 DWT and a speed of 14.5 knots. Any given tanker's T-2 equivalent capability is equal to its DWT x speed/16,500 x 14.5.

As of 1 October 1973, the operational Government-owned tankers consisted of the following:

- Four T-1 type tankers with 4,000-DWT and 28,000-bbl capacity. Because of their small size, they are not adequate for major point-to-point transportation. They are dedicated to Far East coastal movements and Mid-Pacific island resupply.

- Four T-5 type tankers with 26,000-DWT and 195,000-bbl capacity. They are approximately 15 years old and give efficient, economic service.

- Eight T-2 type tankers with 16,500-DWT and 135,000-bbl capacity. These are World War II era ships and are all 30 years old. Though extremely handy for military-type distribution requirements, their age makes them an extremely limited and unreliable asset. These tankers are scheduled for deactivation in 1974 and will be replaced

by nine new tankers each with 25,000-DWT and approximately 220,000-bbl capacity. These tankers are currently being constructed in two private U.S. shipyards for delivery in 1974. Their size and speed will almost double the lift capability of the T-2's. Of particular note is that these tankers will not be Government-owned. Owing to lack of Government funds, they are being built and financed by private interests under the "build and charter" concept and will come under long-term bare-boat charter to MSC (5-year increments, with options up to 20 years). As they will be crewed, operated, and maintained by MSC, they are in effect dedicated Government assets.

The National Defense Reserve Fleet (NDRF) provides the capability to expand the Government-controlled nucleus tanker fleet in event of a contingency. This fleet is maintained and preserved for national defense use by the Maritime Administration. As of 1 October 1973, there were 26 tankers of the T-2/T-3 design (16,000 to 18,000 DWT, i.e., 130,000- to 140,000-bbl capacity each) in the NDRF (Ref. 21). They are all of the 28- to 32-year age group and require significant upgrading prior to any military usage. The specific time and money involved will depend on each ship's material condition and its last date of operation. All NDRF tankers are scheduled to be scrapped by FY77.

Because of the inflexibility of the composition of the nucleus fleet, MSC meets extra tanker transportation requirements by going to the commercial tanker market for new charters. This is usually done on a "spot" basis (one or two voyages) to meet the specific need, or if circumstances indicate a long-range requirement, on a 1- to 5-year basis. To obtain these tankers, and the major portion of the normal dedicated MSC fleet, DoD relies on the availability of privately owned ships either from petroleum companies (if they are in a surplus tonnage situation) or independent shipowners. DoD's needs are in competition with worldwide petroleum transportation demands and overseas grain shipments. Normally, grain does not have a significant impact, but its role has been larger than usual during 1973 because of heavy export sales. Historically, DoD tanker requirements have been satisfied by the private tanker market. Ships have been chartered either from the U.S. flag fleet or in a few instances from foreign flag sources. Foreign flag tankers can be utilized when a determination is made by the ASD(I&L) that U.S. flag charters are not reasonably available. This was done during the Vietnam conflict and is the current situation. These foreign flag tankers are obtained on a commercial chartered basis—not by

requisitioning ships from the U.S. effective control fleet (U.S. company-controlled ships of Panamanian, Honduran, or Liberian registry). Requisitioning of U.S. flag or U.S. effective control tankers can be effected only upon declaration of a national emergency. Such requisitioning has not occurred since World War II. An important limitation on utilization of foreign flag ships is that they cannot be employed in U.S. domestic trade. Although these foreign flag, effective U.S. control, tankers are a potential asset in event of a major contingency, the rapid availability of relatively small (40,000 DWT and under) clean multiproduct tankers for DoD needs is not assured. These ships are in established overseas trade routes and any requisitioning for military use could cause disruption of worldwide domestic oil distribution. It is further noted that in 1971 the average Liberian tanker had a capacity of 56,400 DWT; and Panamanian, 62,100 DWT (Ref. 22).

The current tanker market (October 1973) is in a demand situation. Available tankers of any flag are receiving extremely high freight rates. Inasmuch as MSC must charter spot voyages at the going rate, increased costs of transportation for the military services result. It has been predicted that a gradual decline will be experienced in average world rates during the seventies, although no sustained collapse can be expected and there will be seasonal peaks and troughs (Ref. 23). Tanker rates are extremely volatile, though, and can drastically change overnight because of some major world event, such as a massive grain sale or a Middle East war.

With the increase in oil imports to the United States and general worldwide increased petroleum requirements, there will be a significant increase in tanker requirements. The U.S. demand alone is expected to rise from 24.2 million DWT in 1973 to 63 million in 1975 and 115.2 million by 1980. Worldwide, it is expected that there will be an added 89 million DWT between March 1973 and mid-1975. An additional factor contributing to this increase for the United States is the changing source of supply from Caribbean to Middle East sources (assuming the embargo is lifted). The long haul from the Arabian Gulf will create a greater volumetric increase in imports to the United States than to either Western Europe or Japan. As a result, tanker capacity for U.S. oil imports will raise the U.S. proportion of world demand from an estimated 14 percent in 1971 to about 20 percent in 1975 and over 25 percent in 1980 (Ref. 23).

There are numerous studies and discussions regarding projected tanker tonnage demand, availability, and construction. For this review, however, it is sufficient to note that world tanker tonnage is rapidly increasing to keep up with world demand; that supply-versus-demand

studies are highly susceptible to changing world conditions (new production fields such as the Alaskan North Slope, wars, national policy changes, change in the Suez Canal status, major pipeline construction, etc.); and most importantly, that the majority of new tankers being built are large carriers (up to 700,000 DWT) designed for the crude oil trade—commonly referred to as VLCCs (Very Large Crude Carriers).

As of 30 June 1973, there were 215 major oil-carrying ocean-going tankers (total DWT—7,563.4 million) in the U.S. flag fleet. The tankers are almost equally owned by either oil companies (48 percent) or independent shipowners (52 percent). The distribution in size ranges from the T-2 of 16,500 DWT, 31-ft draft, 524-ft length, and 68-ft beam; to the new Mobil Oil Company ships of 129,000 DWT, 55-ft draft, 930-ft length, and 132-ft beam. U.S. tankers larger than 200,000 DWT are being constructed but are not yet operating. A grouping by DWT size range and age is given in Table 3-5 (Ref. 21).

TABLE 3-5

U.S. TANKER INVENTORY

Age (Years)	Capacity (Thousands of DWT)					Total
	25 & Under	26-35	36-39	40-49	50 & Above	
	Number of Ships					
Under 5	0	0	10	0	19	29
5-9	1	1	4	0	3	9
10-14	2	17	0	10	9	38
15-19	4	31	4	3	1	43
20-24	6	16	1	2	0	25
25 & older	50	21	0	0	0	71
Total	63	86	19	15	32	215

The composition of the U.S. tanker fleet is dramatically shifting by addition of and replacement with larger size tankers that cannot provide support to DoD on a normal basis or in a contingency where

physical port constraints exist. These larger tankers will be devoted to the crude trade, and their ability to handle DoD refined products will be minimal. Sufficient numbers of small tankers are currently available, but they are becoming noncompetitive for commercial use and are being phased out and replaced by large tankers (Ref. 24). In its review of demand for certain tanker sizes, H.P. Drewry Limited (London shipping consultants) expects an increase in U.S. demand for under-50,000-DWT tankers (owing to port restrictions) to lead to a severe shortage of this size by the midseventies (Ref. 23).

The physical limitations of military petroleum terminal facilities is a constraint on DoD's using large privately owned tankers. Military discharge terminals, to a large degree, do not possess water depth or pier facilities to berth fully laden tankers above 35,000 DWT. This was no problem after World War II when the T-2 tanker was common. The smallest tanker being built today, however, is around 38,000 DWT, 37-ft draft, 660-ft length overall, and 90-ft beam. Military terminals have not grown accordingly. In CONUS alone, only five east coast and six west coast terminals can accommodate a fully loaded 35,000- to 49,000-DWT tanker (Ref. 19). Furthermore, in the event of a contingency such as Vietnam, the existing port facilities may again prove to be inadequate. Commercial deep-water ports are of minor consideration because they are mainly used for crude oils.

The most efficient usage of a tanker involves going fully loaded from a single-loading terminal to a single-discharge terminal. Military requirements are for a smaller quantity than a fully loaded 38,000-DWT tanker. This fact, coupled with physical terminal constraints, prevents full economical commercial usage of a tanker of this size.

A partial solution to this problem lies in maintaining an MSC nucleus and chartered tanker fleet with sufficient numbers of small-size ships. The new construction of 25,000-DWT, 32-ft draft tankers for the MSC nucleus fleet will provide some assurance that small tankers will be available for military use.

Support of a major overseas contingency or a large-scale war would be very demanding on tanker assets but not impossible. Current DoD planning calls for reliance on commercial tankers (expanded MSC-controlled fleet and use of effective control Panamanian, Honduran, and Liberian flags). The Weapon Systems Evaluation Group (WSEG) Report 204, in dealing with a large-scale war in Central Europe from 1976 to 1981, concludes that the capabilities of this fleet are sufficient to meet contingency requirements (Ref. 25).

This report derived a worldwide war tanker requirement of 2.6 million DWT. It is interesting to note that MSC-controlled tanker tonnage during FY68 (at the height of Vietnam activity) was 2.5 million DWT, and national defense emergency ship requisitioning was not utilized. An assumption of the WSEG report was that sufficient numbers of tankers under 60,000 DWT with drafts under 40 ft would be available, and that there would be comparable terminals. This assumption is questionable when the following factors are considered:

- The additional need for this small-size tanker in military support of other worldwide requirements (including CONUS)
- The increasing tanker size trend and its effect on available ships by 1980
- MSC studies that reveal there are six European military POL terminals that can accommodate a fully loaded 50,000-DWT tanker, of which only three can handle a 60,000- to 80,000-DWT tanker.

Future contingency planning will have to consider the use of large tankers, offshore POL mooring buoys, floating storage, and small coastal shuttle tankers.

A large-scale war in Asia, with the Mideast supply line severed, would require considerably more tanker tonnage than the NATO scenario. POL supply lines would have to extend from the U.S. Gulf or Caribbean to the theater of operations; whereas, during the Vietnam conflict, the Arabian Gulf was a major supply point. Again, emergency tanker requisitioning and maximum utilization of large tankers (with subsequent coastal shuttles) would be necessary.

Another aspect to tanker support of a major contingency, however, is the possibility of a threatening naval force. Considerations must then be given to compensation for tanker attrition and the need for convoying. In the event of a major contingency, where a hostile naval force is present, the sealift of military petroleum would be vulnerable to disruption. Chapter 9 (classified supplement) discusses this topic.

3.3.2.2 Land Transportation

Rail tank cars, tank trucks, inland barges, and pipelines are the modes of land transportation used to distribute DoD bulk POL products from the refinery, storage, or ocean terminal to the inland activity consumer. Within CONUS, this distribution is accomplished by either direct contractor delivery in their own equipment, or contracted for through MTMTS, the designated DoD single manager for movement of inland transportation. Land movement of POL in overseas areas is a function of the military service designated by the unified commander and involves both military and commercial distribution systems and equipment. It is estimated that MTMTS establishes tariffs and routing for more than 50 percent of all DoD movement in CONUS. See Table 3-6 for FY73 MTMTS POL movement.

TABLE 3-6

CONUS POL MOVEMENT
(MTMTS TARIFFS AND ROUTINGS)
IN FISCAL YEAR 1973

Mode	Thousands of Barrels	Percent of Total
Rail	5,978	7.1
Truck	13,496	15.9
Water	21,708	25.6
Pipeline	43,514	51.5

The balance of DoD POL movement in CONUS is attributed largely to contractor destination deliveries, with a lesser portion consumed on the coasts and supplied direct from tanker deliveries. This amount cannot be quantified at this time because of the lack of available data.

An MTMTS 1973 update of available private barge assets revealed that units and associated capacity have increased more than 29 percent since 1967. Almost 75 percent of the barge fleet was operating on the Mississippi River and Gulf Intercoastal Waterway.

As previously indicated, DoD CONUS rail tank car movement of petroleum relies solely on military-owned rolling stock. Commercial leasing companies are available, but at present there is paucity of stock to meet demand; so DoD cannot rely on them. This is not considered critical because of the normally minor role played by rail transportation in product movement. The military rail assets are included in what is titled the Defense Freight Rail Interchange Fleet (DFRIF), controlled and operated by MTMTS. These rail assets are given in Table 3-7.

TABLE 3-7

DEFENSE FREIGHT RAIL INTERCHANGE FLEET

Age (Years)	No. of Cars	Size (each) (Gallons)	Total Capacity (Tallons)
32	2	8,000	16,000
21-35	1,767	10,000	17,670,000
21-31	99	11,000	1,089,000
Total	1,868	--	18,775,000

Of the total 1, 68 cars, approximately 10 percent are down for maintenance at any given time, thereby providing for a total usable capacity of 16,895,000 gal. MTMTS estimates only 50 percent of the available capability was effectively used in FY73 primarily because of the following:

- Tendency of field facilities to retain cars for temporary storage, vice quick turnaround
- Logistic problems of positioning cars to meet changing sources of supply.

As shown in the tabulation, the DFRIF assets are approaching the end of economic utilization when considering a normal useful life of 40 years. Based on a 1971 study, a modernization program has been undertaken to ensure future assets. Under this procurement program, MTMTS will obtain 750 20,000-gal capacity tank cars. Delivery will commence in mid-1974 with completion in early 1976.

Overseas peacetime land distribution of DoD POL is a combination of U.S. military, treaty organization, and domestic capabilities. This system has proved to be adequate with no serious overall faults. The degree of efficiency during a major contingency varies between the countries concerned. In the WSEG Report 204, this subject was discussed in considering a major central European war involving NATO forces (Ref. 25). It was brought out that although a complete military-controlled distribution capability is preferable, the most promising course of action involves integration of military-controlled and existing commercial systems. Such an action would reduce peacetime costs in maintaining a war reserve inventory, and utilization of commercial POL systems would increase availability of POL to military forces in wartime.

3.4 CONCLUSIONS

3.4.1 Storage

- The lack of standardized and reliable data reporting, within both DoD and various Government agencies, makes it difficult to get an accurate assessment of the petroleum storage and inventory situation.

- There is sufficient gross DoD storage capacity worldwide to meet currently established POS and PWRR levels for strategically important petroleum products. However, not enough information is available to show how much of that tankage can be utilized effectively.

- Additional on-base storage capacity is being planned to provide a 30-day stock level for heating oil. However, achieving such levels is proving difficult because of scarcity of supplies.

- Difficulties being encountered in procuring petroleum products may dictate the need for increasing authorized terminal and base stock levels to take advantage of spot procurements and achieving levels on an opportune basis.

3.4.2 Ocean Transportation

- Composition of the world tanker fleet is dramatically shifting by addition of and replacement with larger size tankers that cannot provide support to DoD on a normal basis or in a contingency where physical port constraints exist.

- Minor contingencies requiring increased tanker support through the seventies (military operations and/or a radical change in DoD procurement sources) can be provided for from the MSC-controlled fleet and by chartering additional privately owned tonnage (U.S. and foreign). Adequate-size commercial tankers will still exist during this period. There will be competing demand for these ships but they should be obtainable, though perhaps for a high price. Support of a major overseas contingency or large-scale war would be most demanding on tanker assets but achieveable. Current DoD planning calls for reliance on commercial tankers (expanded MSC-controlled fleet and use of effective control Panamanian, Honduran, and Liberian flags).

- The NDRF is still a last resort capability, representing minimum assets, only until FY77 when scrapping is scheduled to be completed.

3.4.3 Land Transportation

- There appears to be no problem in continued reliance during peacetime on commercial transportation to satisfy most of the DoD requirements.

- The impact of a major contingency on land POL transportation would most likely be overseas and would affect intratheater distribution.

3.5 RECOMMENDATIONS

3-1. The Defense Supply Agency should acquire petroleum facilities for use as central distribution points through 3- to 5-year lease arrangements to meet shortfalls in heating fuel and ground

operations supply. Associated budgetary and manpower impact should be quantified by DSA and submitted to the Assistant Secretary of Defense (Installations and Logistics) for approval.

3-2. The Defense Supply Agency should conduct detailed joint reviews of storage requirements for FY75 to FY79 (as required by DODD 4140.25 and DOD 4140.25M) and report the results to the Assistant Secretary of Defense (Installations and Logistics) by 1 February 1974 with 1 April annual updates thereafter. The review of storage capabilities should encompass:

- On-base and terminal facilities
- Accuracy of reporting system
- Utilization and material condition of available assets, including programs for necessary repair and rehabilitation of tankage
- Disposition recommendations for malpositioned or underutilized tankage assets including joint utilization and/or exchange of facilities between the Department of Defense and industry.

3-3. The Services should prepare programs for modernizing strategic, high-usage military POL terminals (e.g., Norfolk, Rota, Sasebo, Subic) to accommodate tankers up to 80,000 DWT, and review current capability and R&D programs to provide for over-the-beach discharge in view of increasing tanker size.

3-4. The Assistant Secretary of Defense (Installations and Logistics) should ensure that the Military Sealift Command-controlled tanker fleet possesses sufficient small tanker capability to support war and/or peacetime military shallow-draft POL requirements. The current construction program for building nine handy-size tankers is strongly endorsed and should be extended.

CHAPTER 4

FUELS STANDARDIZATION

4.1 INTRODUCTION

This chapter addresses the problem of what should be done to reduce the number and types of fuels used by the military services. The concept of replacing unique military fuel types, specifications, and test methods by standardizing on the most available commercial equivalent fuels, specifications, and test methods is presented. A review of the current DoD standardization policies, organizations, and management as they relate to fuels is made. Past and current fuels standardization programs and their impact are discussed and form the basis from which conclusions and recommendations are drawn.

4.2 DOD AND MILITARY SERVICES STANDARDIZATION POLICY

DoD policy directives and manuals have established the necessary basis for an effective Defense Standardization Program (DSP). The DSP is designed to accomplish the basic goals of (1) preventing overlapping and duplicative specifications; (2) fostering the reuse of existing technology; (3) establishing uniformity in grades, classes, sizes, and levels of performance; and (4) systematically reviewing inventory items to reduce or eliminate varieties and sizes to the minimum compatible with military service operating needs (Ref. 1).

Responsibility for overall review and coordination of the DSP is assigned to the Defense Materiel Specifications and Standards Board (DMSSB), which reports to the Deputy Secretary of Defense in the discharge of these responsibilities. The Board consists of one representative from the Office of Director of Defense Research and Engineering (ODDR&E), the Office of the Assistant Secretary of Defense (Installations and Logistics) [OASD (I&L)], and the Defense Supply Agency (DSA), and two representatives from each military department. The ASD(I&L) provides the Standards Board Secretariat, and in consultation with DDR&E, designates the Board Chairman. This Board was first

provided for in DoDD 4120.3 and was organized on 1 July 1973. The Board is to establish commodity-oriented panels to conduct studies, analyze progress, and determine the effectiveness of the DSP. The panels may establish ad hoc committees or working groups to accomplish specific tasks or projects (Ref. 1).

Upon the recommendation of the Standards Board, the Secretary of Defense may assign portions of the DSP to DoD components for management purposes. DSA has been assigned overall responsibility for fuels and lubricants (Ref. 2), and has authority to make standardization decisions for these items. Standardization decisions are subject to reclama by DoD components to the Secretary of Defense for final resolution (Ref. 1).

Although DSA has been assigned integrated management responsibility for bulk petroleum products, DoD directives also delegate certain responsibilities for the management of petroleum products among the Joint Chiefs of Staff (JCS), the unified commanders, and the military departments (Ref. 3). The standardization responsibilities for fuels and lubricants are defined in broad terms and there is considerable overlapping of responsibilities.

In addition to DoD directives and manuals, the Air Force and Army have issued directives delineating standardization policies and procedures for fuels and lubricants. All Services have directives that specify the primary, alternate, and emergency fuels that may be used in the power plants of mobile systems (Ref. 4).

Within each military service, standardization on a specific grade for each primary type of fuel (e.g., gasoline, diesel, jet fuel) has been generally achieved for those fuels and lubricants required for weapon systems support, particularly for those fuels and lubricants stored as PWRR. Inter-service standardization on specific grades for each primary type of fuel has been less widely achieved. Alternate or emergency grades are normally limited by directive to fuels and lubricants available from the military supply system except for jet fuels where acceptable alternate commercial fuels are specified in Service technical directives.

4.3 BULK FUELS PROCURED BY MILITARY SERVICES

Table 4-1 provides information on the various types of bulk petroleum fuels that were procured by DFSC for the Services during

TABLE 4-1

BULK FUELS USED BY MILITARY SERVICE

Federal Stock No.	Nomenclature	Military or Federal Specification	ASTM Specification	Barrels Procured for Military Services FY72			
				Air Force	Army	Navy	Total
Aviation Gasolines							
9130-179-1125	Gasoline, Aviation, Grade 115/145	MIL-G-5572	D-910-67	7,499,294	121,935	2,922,826	6,644,955
9130-179-1122	Grade 100/130		D-910-67	146,339	11,666	426	156,433
9130-180-1636	Grade 80/87		D-910-67	1,003	4,761	26,435	32,199
Jet Fuels							
9130-256-8613	Turbine Fuel, Aviation, Grade JP-4	MIL-T-5624	D-1655-8	164,122,154	436,809	7,790,263	172,351,226
9130-273-2379	Grade JP-5	MIL-T-5624[1]	D-1655-6[2]	261,426	6,333	25,512,783	25,782,544
9130-551-2265	Grade JP-6						
9130-180-6385	Grade JP-7						
9130-NSL	Grade JP-6 (Kerosene Type)	MIL-T-83133	D-1655-6				
9130-854-0490	Referee for JP-4 Grade I	MIL-T-5161	D-1655-6				
9130-854-0491	Referee for JP-5 Grade II	MIL-T-5161	D-1655-8	1,306,432	46,255	27,612	1,386,469
9130-753-5026	Grade A-1	ASTM-D1655, Type A-1	Same				
9130-551-2264	JP-TS	MIL-T-25524					
Motor Gasolines							
9130-160-1816	Gasoline, Automotive, Leaded, Combat Type I	MIL-G-3056	D-436-68T	286,420	4,606,369	260,437	5,333,226
9130-160-1830	Combat Type II	MIL-G-3056	D-439-68T				
9130-264-4536	Prelium	FED-VV-G-76	D-439-68T	200,535	573,376	226,293	1,002,194
9130-264-6216	Regular	FED-VV-G-76	D-439-68T				
6130-160-1637		FED-VV-G-109	D-436-68T				
6130-142-6457	Gasoline, Automotive, No/Low Lead, Other: Research and Development	MIL-G-46015	D-439-68T	475,463	562,893	544,187	1,562,573
9130-543-6651	Limited Lead	(Spec.)	D-436-98T				
9130-172-6706	No/Low Lead, Premium	FED-VV-G-1690	D-439-68T	None	33,857	61,687	86,544
9130-167-6775	No/Low Lead, Regular	FED-VV-G-1690	D-439-88T	1,702,807	2,262,102	1,126,317	5,091,229
Diesel Fuels							
9140-273-2377	Diesel Fuel, NATO Symbol F-75, DFM	MIL-F-16884		423,143	6,956,620	5,407,371	14,787,434
9140-286-5266	Grade DF-1, Winter	FED-VV-F-800	D-975-68	120,449	1,452,071	23,146	1,595,668
9140-286-5294	Regular, DF-2	FED-VV-F-800	D-975-68	2,355,381	1,655,214	1,520,191	5,530,786
9140-286-5283	Arctic, DF-A	FED-VV-F-800	D-975-66	1,213,202	147,616	481,426	1,842,546
Fuel Oils							
9140-247-4366	Fuel Oil, Burner, FS-1	FED-VV-F-815	D-396-87	58,335	106,660	55,801	320,996
9140-247-4365	Burner, FS-2	FED-VV-F-815	D-396-67	1,721,067	7,457,946	1,651,717	11,130,733
9140-247-4860	Burner, FS-4	FED-VV-F-815	D-396-67	148,321	300,870	56,787	505,956
9140-247-4356	Burner, FS-5	FED-VV-F-815	D-396-67	463,675	704,034	476,466	1,647,177
9140-247-4854	Burner, FS-6	FED-VV-F-815	D-396-67	1,508,245	4,055,662	13,436,128	16,601,033
9149-160-6084	Diesel (MMS) DFS	AFPID 9140/1					
9140-161-7719	Burner, Low Sulfur FSL						
Kerosene							
6140-242-6746	Kerosene	FED-VV-K-211	—	120,733	105,612	99,695	313,410
Navy Distillate							
6140-145-0004	Fuel Oil, Burner, Navy Distillate	MIL-F-24397	—	7,369	None	34,265,444	24,402,824
Navy Special							
6140-256-6610	Fuel Oil, Burner, Navy Special	MIL-F-859	—	None	16,750	20,634,687	20,841,437

[1] Flash point to 140° F (minimum).

[2] Flash point to 110° to 150° F.

FY 73. The amounts shown as procured should not be confused with the actual quantity delivered to each Service, but are the Services' estimated requirements against which procurement actions were taken Information was not available on the actual amounts of individual grades of fuel delivered to each Service. Experience indicates that between 85 and 90 percent of the quantity contracted for is actually delivered. Therefore, data presented do provide a basis for evaluating the degree of standardization that exists in DoD. The table also clearly shows a general overlapping of military and Federal specifications with the commercial specifications of the American Society for Testing Materials (ASTM). Although not shown in the table, there is a corresponding overlapping of military, Federal, and ASTM test methods, which suggests that military and Federal specifications and test methods should not be developed or perpetuated where paralleling ASTM specifications and test methods could be adopted. It is obvious from the table that although it is a stated policy of DoD to obtain maximum practicable fuels standardization, that goal is far from being achieved in fact.

Standardization by grade for each petroleum primary type has not been achieved either within or between military services for those fuels used to operate military installations. These include fuels and lubricants for motor pool vehicles, military housing, heating plants, electrical generators, construction equipment, special-purpose vehicles, communication and radar sites, etc. The grade is usually determined locally. Bulk annual requirements exceeding $2500 are contracted for centrally by DFSC unless local purchase authority has been granted. DFSC contracts for bulk requirements from commercial oil companies that normally have retail outlets in the vicinity and can deliver a commercial product that meets the grade requested and/or the applicable military or Federal specification. If a specification cannot be met and it is not critical to the local requirement, it is normally waived by DFSC. The contract awards and prices are published in post, camp, and station contract bulletins.

4.4 PAST DOD STANDARDIZATION PROGRAMS AND THEIR RESULTS

In the early 1950's the North Atlantic Treaty Organization (NATO) Petroleum Planning Committee was established to aid the Committee on Wartime Commodity Planning. Under the NATO Council, the Petroleum Planning Committee was charged with (1) determining petroleum needs of NATO nations and NATO forces, (2) studying sources and availability of petroleum and petroleum facilities, and (3) proposing a system of coordination in the overall supply and demand of petroleum

products (civil plus military for NATO nations, allies, and friendly neutrals). In accomplishing the third task, the NATO Petroleum Planning Committee has developed and published an "Interchangeability Chart of Standardized Fuels, Lubricants and Associated Products." This publication is a major contribution toward providing essential information on the standardization and interchangeability of petroleum products between NATO members. The publication is being continuously reviewed and updated to ensure that it remains current.

By memorandum to ASD(I&L), dated 29 June 1960, DDR&E recommended initiation of a review of military fuel requirements to determine the minimum number of fuels, by type, required to satisfy the needs of the military services. The Director of Petroleum Logistics Policy, then a member of the ASD(I&L) staff, appointed an ad hoc group to consider the problem. The ad hoc group established a strong program to standardize on eight grades of bulk fuel for all DoD operational forces. These included AvGas 115/145; JP-4 jet fuel; JP-5 jet fuel; combat MoGas; Army CIE (later CITE) fuel; Diesel Fuel, Marine; Arctic Diesel; and Navy Special Fuel Oil. This major standardization effort waned with the disestablishment of the Director for Petroleum Logistics Policy in the mid-1960's.

One of the results of the DoD standardization effort was the standardization by all military services on AvGas 115/145. With minor exceptions, 115/145 is still universally used by all military services. The reduction from four AvGas grades (80/87, 91/96, 100/130, and 115/145) to one AvGas greatly improved the logistic support for all military services. However, difficulties are now being experienced by DFSC in obtaining AvGas 115/145 from the petroleum industry. This situation has resulted in a current DFSC inquiry into the possible use of AvGas 100/130 by all military services. The AvGas 100/130 is now more widely available on the commercial market (Ref. 5).

The Defense Standardization Program also spawned an effort by the Army to standardize initially on three fuels: AvGas 115/145, MoGas, and a Compression Ignition Engine (CIE) fuel. Later, this CIE fuel was expanded to the Compression Ignition and Turbine Engine (CITE) fuel. The use of CITE fuel was based on the development and introduction of vehicles equipped with compression ignition (diesel) engines that could utilize fuels ranging from motor gasoline to diesel fuel. The primary CITE fuel to be used in the engine was a blend of 60 percent gasoline and 40 percent kerosene. The basic rationale for adopting the CITE fuel and multifuel engine was an anticipated shortage

of distillates under general war conditions. This expectation resulted in an initial standardization on three fuels for Army combat use with the eventual objective of standardizing on only CITE fuel to simplify fuel distribution logistics during conflict.

The benefits that were expected from standardizing on CITE fuel included a 45 percent increase over gasoline-powered vehicles in both range and economy of operation, increased flexibility to use other fuels in an emergency, and simplified storage and distribution of fuels required by the Army.

Initially, it was planned that vehicles with less than 150 hp would use gasoline. Vehicles of 150 hp and over were to be equipped with the multifuel engine and use CITE fuel. During 1962, all 2-1/2-ton trucks (M35A1), 5-ton trucks (M54A1), and 5-ton tractors (M52A1) were procured with multifuel engines. CITE fuel specification (MIL-F-46005) was developed and CITE fuel was produced by 1963 in sufficient quantities to meet Army requirements. At first, the use of CITE fuel was limited to the 3d Army where after 1 July 1963 CITE fuel was used exclusively in multifuel engine vehicles. The 3d Army was to field test the CITE fuel concept before it was introduced to other Army units. In 1965 the concept of CITE fuel was expanded to include use in aircraft turbine engines. Severe operating design problems associated with the multifuel engine plus duplication of JP-4 and JP-5 jet fuels for aircraft turbines were given as rationale for phasing out the CITE fuel concept on 28 July 1970 (Ref. 6).

The CITE fuel standardization attempt is an example of a concept that was too broad, premature, and revolutionary in scope. Standardization on new fuels and power units burning these fuels before they are fully proved must be avoided in the future.

4.5 CURRENT STANDARDIZATION ACTIONS

The standardization programs now underway are occurring in three different categories. These are standardizations (1) within individual military services to convert to and standardize on a more acceptable fuel, (2) standardization studies directed by DoD to eliminate one of two duplicating products or substitute a different grade of fuel where the preferred grade cannot be procured, and (3) efforts within a theater of operation to standardize on the most commonly available fuel type to simplify storage and distribution, and enhance availability

and commonality with allies. The current standardization programs in NATO are a new and promising approach that fall in the third category and indicate the approach that may have to be taken by DoD components to cope with the energy situation, that is, standardize on the most widely available commercial fuel.

4.5.1 Ship Propulsion Fuels

In 1969 the Secretary of Defense approved the Navy Distillate (ND) Fuel Program proposed by the Secretary of the Navy for the conversion of boiler, gas turbine, and diesel-powered ships of the Navy from three fuels—Navy Special Fuel Oil (NSFO), JP-5, and Diesel Fuel, Marine (DFM)—to a standard distillate fuel identified as ND fuel. It was estimated that such a program would result in net benefits of $138 million per year for an investment of $28 million. Significant improvements in fleet readiness, logistic support capabilities, and shipboard engineering personnel morale and retention were major supporting considerations. The program involved the immediate initiation of conversion of boiler-powered ships and further testing to determine the optimum characteristics of a single shipboard propulsion fuel.

Approximately two-thirds of the boiler-powered ships of the Navy have been converted from NSFO to ND fuel. The remaining conversions are scheduled to be essentially completed by the end of FY74. The major features involved in the conversion include fuel oil system conversion by pump modification or replacement, combustion control system modifications, burner assembly modification, and ballast compensation. Problems were experienced with high-pressure fuel-oil service pump performance but are being resolved. The benefits achieved in boiler cleanliness and consequent reduction in stack gas effluents and shipboard personnel morale are considered by the Navy to outweigh component performance problems experienced to date. The Navy, accordingly, is proceeding with the conversion as scheduled.

Based on an extensive economic and technical analysis, the Navy concluded in 1972 that maximum cost benefit would be achieved by standardizing on a distillate fuel approximating the technical characteristics of DFM* modified to permit higher pour and cloud points. Accordingly, it was planned to adopt the modified DFM (which was slightly more

*DFM modified is fully compatible with ND fuels, and is more attractive for use with diesel engines and gas turbines.

expensive than ND) as the single shipboard propulsion fuel for nonnuclear-powered ships effective July 1974. However, subsequent unanticipated developments in the supply and demand relationships among the distillate fuels, with the resultant increase in the price differential between DFM and ND from $0.23 a barrel to $1.31 a barrel, invalidated the earlier economic analysis conducted by the Navy. The net effect of such an increase in cost was estimated at about $25 million in FY75 and over $30 million annually in subsequent years. The Navy has deferred the action to adopt modified DFM as the single distillate fuel pending further economic and technical analysis.

4.5.2 Air Force JP-8 Conversion Study

The Air Force is currently studying the feasibility of replacing the standard JP-4 with a safer kerosene fuel similar to commercial Jet A-1, designated JP-8. The primary difference between commercial Jet A-1 and JP-8 is the addition of anti-icing and corrosion inhibitors. The Air Force became interested in the feasbility of using JP-8, which is a low-volatility fuel, in response to a Tactical Air Command (TAC) stated need for a safer fuel to enhance aircraft survivability in combat (Ref. 7). In 1968 the Air Force Aerospace Propulsion Laboratory assessed the influence of volatility on the vulnerability of jet fuels to gunfire-induced fires by comparing the results of open fire tests on fuel tanks filled with JP-4, JP-5, and JP-8. The results indicated all jet fuels constituted a fire hazard with equal vulnerability in the propulsion system. There was a tentative preference for JP-8 or JP-5 over JP-4 when considering fuel tank explosion hazard and aircraft crash hazard under certain conditions. In aircraft servicing and maintenance operations, it was determined that either JP-8 or JP-5 would be advantageous from a safety standpoint. The gunfire test results and the TAC requirement for a safer fuel spawned a test program to determine the initial impact of using JP-8 in typical Southeast Asia aircraft and ground support equipment. A field comparison between JP-4 and JP-8 was conducted to evaluate aerial relight, exhaust smoke emission, engine performance, ground start characteristics, and maintenance requirements. The field test was terminated before completion of all planned tests, including tests on ground support equipment, when it became clear that immediate use of JP-8 in Southeast Asia would be premature without further extensive testing. Problems in ground start and altitude relight were experienced with some of the test aircraft.

Although JP-4 and JP-5 (similar to JP-8) were both in use in Southeast Asia, the available combat loss data were inadequate to

determine the superiority of one fuel over another. This was due to many variables related to missions, ordnance, and gaps in the data required. The only data subject to analysis were for external fuel tanks. Too few cases were involved to be conclusive, but no fires or explosions occurred with JP-5 and a high percentage occurred with JP-4. In 1972 the Air Force Aero-Propulsion Laboratory (AFAPL) initiated a flight test program at Edwards AFB, California, to determine the entire F-4-airstart envelope for JP-8 fuel. The only degradation in airstart capability, with main fuel controls adjusted to JP-4 setting and with testing at several points on the JP-4 envelope, was an increase in airstart times of 10 to 15 seconds, which is considered to be operationally acceptable. It is understood that an Air Force study group that was convened to study the impact of replacing JP-4 with JP-8 will recommend adoption of JP-8 based on safety of flight as well as technical operating considerations.

From the fuel management standpoint, adoption of JP-8 has two other advantages:

- Widespread availability of JP-8 as commercial Jet A-1 would significantly ease logistic problems
- It would result in a standard DoD jet fuel except possibly for:
  - Shipboard use in which its low flash point has been considered a safety hazard
  - Low temperature operations requiring JP-4

Disadvantages of converting to JP-8 are:

- It may not be suitable for operation where ambient temperatures fall below its freezing point of -54°F.
- Several aircraft types in the current Air Force inventory will need modified fuel ignition systems.
- Engines burning JP-8 tend to emit more smoke.
- At present JP-8 costs about 7 percent more than JP-4. However, increasing demand by the petrochemical industry for naphtha feedstocks, also used for JP-4 production, may tend to equalize prices.
- It would create additional demand in the already short middle distillate range products.

It is worth noting that the military specification for JP-8 parallels an existing ASTM specification for commercial Jet A-1. Although JP-8 does contain additional anti-icing and corrosion inhibiting agents, these could be covered by a modification to the ASTM specification.

4.5.3 Aviation Gasoline Standardization

In August 1973 the Commander, DFSC, requested the Services to evaluate the feasibility of standardizing on AvGas 100/130 for all reciprocating aircraft, replacing AvGas 115/145, which is the current standardized fuel. Two Army, 22 Navy, and 47 Air Force aircraft types would be affected by this action. AvGas currently comprises 4 percent of the total DoD aviation fuel requirements.

The Army has indicated that such a change is feasible and would impose only minor limitations on one type of aircraft that is already scheduled for deletion from the inventory in January 1974. The Navy evaluation shows that even though technically feasible, the switch to AvGas 100/130 would cause significant reductions in maximum power output for certain aircraft. The resulting risk to flying safety is considered unacceptable, and the Navy has advised DFSC of its continued requirement for AvGas 115/145 as the standardized reciprocating engine aircraft fuel. A preliminary Air Force evaluation shows that conversion to AvGas 100/130 would present significant operational and safety problems for nine types of aircraft. Accordingly, the Air Force considers it essential that AvGas 115/145 continue to be provided for those aircraft. Neither the Navy nor the Air Force has addressed the projected lifetime of the affected aircraft in the operational inventory.

Most of the remaining nonmilitary reciprocating-engine aircraft operating in the United States are small private aircraft that burn AvGas 100/130 and lower grades of aviation gasoline. Accordingly, the Services are almost the only customers for AvGas 115/145, and their requirements with the increasing use of jet aircraft are too small to justify refinery production in most cases. Further, the alkylates needed for blending AvGas 115/145 are also used in no-lead or low-lead gasoline for which demand is increasing rapidly. DoD aviation gasoline requirements for FY74 and subsequent years are estimated to be about 6.5 million bbl./year. Since the Services have already standardized on AvGas 115/145, the conversion to AvGas 100/130 as a standardized type will have no effect on fuel minimization. It should, however, result in decreased fuel costs and increased product

availability, since AvGas 100/130 is the product more widely available commercially. In fact, the growing scarcity of AvGas 115/145 may force the conversion anyway.

4.5.4 NATO F-54 Diesel Fuel Standardization

The U.S. Commander in Chief, Europe (USCINCEUR), brought the total lack of fuel standardization to the attention of the Joint Chiefs of Staff in December 1972. The proliferation of 10 different grades of distillate fuels among the U.S. forces and their NATO allies was cited as the prime example of failure to accomplish the universally acclaimed goal of standardization in fuels. USCINCEUR suggested that JCS in consultation with OSD initiate a study to resolve the European fuel standardization problem (Ref. 8). DFSC was tasked to chair a study team to resolve the lack of standardization of diesel, among other fuels, on a worldwide basis but with emphasis on Europe. The study team established a plan with a goal to reduce the number of diesel fuels used by U.S. forces and NATO allies in central Europe from three (DF-1, DF-2, and NATO F-54) to one. The study team selected NATO F-54 as the most acceptable diesel fuel; it was also the most available diesel fuel commercially. In addition, it was the fuel most widely used by the armed forces of NATO countries. Before NATO F-54 diesel could be selected for standardization, an assessment had to be made to determine the effects it would have on the performance and fuel-related maintenance of U.S. forces' equipment and heating systems. It was determined that NATO F-54 would pose problems to U.S. equipment because of two characteristics: a 1 percent permissible sulfur content and a 725°F final boiling point. A check with an engine manufacturer (Detroit Diesel) (Ref. 9) confirmed the sulfur content and final boiling point would have to be lowered to 0.7 percent and 700°F respectively to be acceptable. An analysis showed most diesel fuels manufactured to NATO F-54 standards conformed to the limits required by U.S. forces. The U.S. Army member to the NATO/Military Agency for standardization of Army fuels was instructed to try to obtain agreement at the June 1973 meeting in Brussels to lower the limit on sulfur content from 1.0 to 0.7 percent and the distillation end point criteria from 725° to 700°F. Agreement to the proposed changes was obtained and the NATO F-54 fuel standard was modified accordingly. To determine if NATO F-54 cloud and pour points were satisfactory, the work team initiated a study to analyze from climatic data the highest cloud and pour point values that could be selected and still provide reasonable assurance of satisfactory performance in all European areas where U.S. forces operate diesel-powered equipment. The study recommended

that the cloud and pour points as specified in NATO F-54 be accepted as satisfactory.

The final study team decision to recommend to the military services the use of NATO F-54 fuel as the standard fuel for land use in diesel-powered equipment was reached in July 1973. Service concurrences were received in August 1973.

The implementation of this standardization effort is now underway in central Europe. The Army has extended the concept to other parts of the world where such fuels would not be in conflict with local regulations or where extreme low temperatures necessitate a very low pour point product. The use of F-54 within CONUS is precluded by stricter limitations on sulfur content, which are dictated by air pollution abatement regulations.

The standardization report by the working team fails to mention that U.S. forces in Spain and the United Kingdom still are not standardized on NATO F-54. In Spain, the Spanish CAMPSA diesel fuel (similar to F-54) is used by the Air Force. In the United Kingdom, the predominant diesel fuel used by the Air Force and Navy shore facilities is DF-2. The use of other diesel fuels in England and Spain may not impact adversely on logistic support, since they are supplied and transported locally. The status of F-54 diesel fuel standardization in Italy, Greece, and Turkey are not mentioned in the DFSC standardization study tentative report.

4.5.5 Standardization of Motor Gasoline

The DFSC Ad Hoc Committee established a program to standardize the use of gasolines in Europe. Although NATO F-46 gasoline is the predominant fuel used by the European NATO military forces and by a large segment of Europe commercial users, the U. S. Army has continued to use combat gasoline MIL-G-5056 C for its operations. The primary reason for the U. S. Army position is the lower octane number called for in the NATO F-46 standard, that is, 91 Research Octane Number (RON) (minimum). Combat gasoline requires a 95 RON (minimum). The DFSC Ad Hoc Committee requested the Army to reexamine its position to allow standardization on the most available and commonly used fuel in Europe, NATO F-46.

At the Committee's request, the Army reviewed the gasoline engines within its system to determine whether there were engines that required a higher octane value than 91 RON to operate satisfactorily. The review identified four heavy-duty engines used in tactical vehicles which would experience deterioration and abnormal combustion if operated on a 91 RON gasoline (Ref. 10). The Committee also requested that a survey be made to show the numerical density by location of the identified octane-critical engines. This survey showed a significant number of these engines were in tactical vehicles within the European theater.

Coincidentally, the Army had begun an extensive test in conjunction with an Army Materiel Command Pollution Abatement Impact Program, which had a direct impact on the standardization program to convert to 91 RON (NATO F-46) gasoline in Europe. The Army was conducting tests at Ft. Carlson, Ft. Eustis, Letterkenny Depot, and Deseret Test Center to determine the effects of unleaded 91 RON gasoline (Federal Specification VV-G-001690, Special Grade) when used in vehicles across-the-board at each of the selected installations. The distribution types and vintages of both tactical and facility support vehicles were considered representative and included the four octane-critical engines identified in the survey conducted for the Committee. The Army Materiel Command was in the process of conducting the test to determine the impact and prepare for the use of unleaded gasoline that was expected to become mandatory by law in the late 1970's. The use of no-lead or low-lead gasoline, at the earliest possible date, was directed by a memorandum from the Deputy Secretary of Defense to implement Federal Property Management Temporary Regulation E-12, "Gasoline for Use in Motor Vehicles," dated 26 October 1970 (Ref. 11).

In view of the Army Test Program, the Committee decided to defer final determination on the acceptability of NATO F-46 gasoline for standardization until the results of the program could be evaluated. The Army tests are scheduled for completion in January 1974.

The DFSC Preliminary Committee Report leaves the impression that the F-46 NATO standardization program will be implemented throughout the European theater. In fact, the only areas where gasoline is received, distributed, and stored in bulk under the control of U.S. forces are Spain and central Europe. Motor gasolines for England, Italy, Greece, and Turkey are usually obtained from local commercial suppliers through overseas post, camp, and station contracts awarded by DFSC. The standardization on F-46 NATO gasoline would be effective only if this fuel were available from local suppliers.

4.6 CONCLUSIONS

- DoD policy directives and manuals have not established clear guidelines and organization for an effective Defense Standardization Program for fuels.

- Intraservice standardization has been largely achieved for fuels and lubricants required for weapons systems, particularly those products stored as prepositioned war reserve stock (PWRS). However, interservice standardization has been only partially achieved.

- The Services have contributed to the proliferation of fuel types by specification of performance and test requirements with little apparent regard for the availability of commercial products (see Table 1).

- Standardization has not been achieved, either within or between the Services, for fuels used to operate military installations. However, this lack of standardization is not objectionable because the existing practice of local control has proved flexible, reliable, and responsive to military needs.

- Significant benefits would accrue to the Navy and the Department of Defense by standardization on a single shipboard propulsion fuel when it becomes economically feasible. If this were a diesel type, further potential standardization could be achieved on a single fuel for both shipboard and ground equipment use.

- Standardization on a primary military jet fuel corresponding to commercial Jet A-1 could offer significant net advantages in logistics and fuel management even if not applicable to shipboard and cold weather operations.

- Although military aviation gasoline is currently standardized on AvGas 115/145, the growing scarcity of this product and the fact that it comprises only 4 percent of the total DoD aviation fuel requirement may force a conversion

to AvGas 100/130, which is the standard commercial product.

Current standardization programs in NATO, such as the recent decision to standardize on F-54 diesel fuel, indicate the approach that may have to be taken by the Department of Defense—standardization on the most widely available commercial fuel.

4.7 RECOMMENDATIONS

4-1. In view of current petroleum product shortages, the Defense Standardization Board should pursue the standardization of fuels within the Department of Defense with a sense of urgency in order to ensure maximum practicable compatibility with the most readily available sources of supply of satisfactory fuels.

4-2. The Director of Defense Research and Engineering should ensure that the capability to use standard and commercially available fuels as well as multiple fuels is incorporated into weapons and support systems designs where possible.

4-3. The Defense Standardization Board should actively pursue a program that has the ultimate objective of specifying a single petroleum fuel for each of the major mobility systems, that is, aircraft, ship, and ground operations.

4-4. The Defense Supply Agency should review existing and newly developed military POL specifications and testing requirements for compatibility with commercial standards. Where the variations are insignificant, the commercial standard should be adopted (with specified exceptions or supplements if necessary) so as to reduce the need for special military and Federal specifications and redundant testing.

4-5. The Defense Standardization Board should explore the feasibility of using NATO F-54 diesel fuel for ship propulsion as well as shore use.

4-6. The Air Force should strongly consider phasing in the use of JP-8 as a standard fuel as supply conditions permit, and the Navy should investigate the feasibility of similar action. The ASTM

specification for Jet A-1 should be used for this fuel but modified to include anti-icing agent and a corrosion inhibitor.

4-7. The Defense Standardization Board should study standardization on commercially available AvGas 100/130 for use in reciprocating engine aircraft, considering the programmed phaseout of aircraft requiring AvGas 115/145.

4-8. The Defense Standardization Board should pursue worldwide standardization on 91 RON (NATO F-46) motor gasoline, and procurement contracts for higher octane gasolines should be awarded only with approved waivers by the Defense Standardization Board.

4-9. The Defense Fuel Supply Center should take the lead in standardizing on commercial fuels to be used by military installations.

CHAPTER 5

NAVAL PETROLEUM RESERVES

5.1 INTRODUCTION

The Naval Petroleum and Oil Shale Reserves are the only known DoD assets presently capable of producing petroleum. Their present and potentially significant contribution to the national security and the growing public awareness of the Reserves make it appropriate to consider them in this report. This chapter discusses the legislative history of the Reserves, their current status, the current policy relating to their exploitation, and their relation to national and DoD petroleum requirements. Recommendations are made concerning future exploration and development of the Petroleum Reserves. This chapter deals primarily with the Petroleum Reserves; however, many of the considerations and factors developed in this study are directly applicable to the Oil Shale Reserves.

5.2 LEGISLATIVE HISTORY

Under the basic authority of the Pickett Act and Title 10, U.S. Code, four naval petroleum and three oil shale reserves have been established and have been subject to varying degrees of development and production. In 1912, the first petroleum reserve, Naval Petroleum Reserve No. 1 (NPR No. 1), was established in Elk Hills, California, by President Taft. Subsequent petroleum reserves were established in Buena Vista Hills, California, in 1912 (NPR No. 2); Teapot Dome, Wyoming, in 1915 (NPR No. 3); and on the North Slope of Alaska near Point Barrow in 1923 (NPR No. 4). On 6 December 1916 Oil Shale Reserves No. 1 and 2 (OSR No. 1 and No. 2) were established in Garfield County, Colorado, and Uinta County, Utah, respectively, by Executive Order of President Wilson. OSR No. 3 was established in an area contiguous with OSR No. 1 in September 1924. The location of these petroleum and oil shale reserves are shown in Figure 5-1.

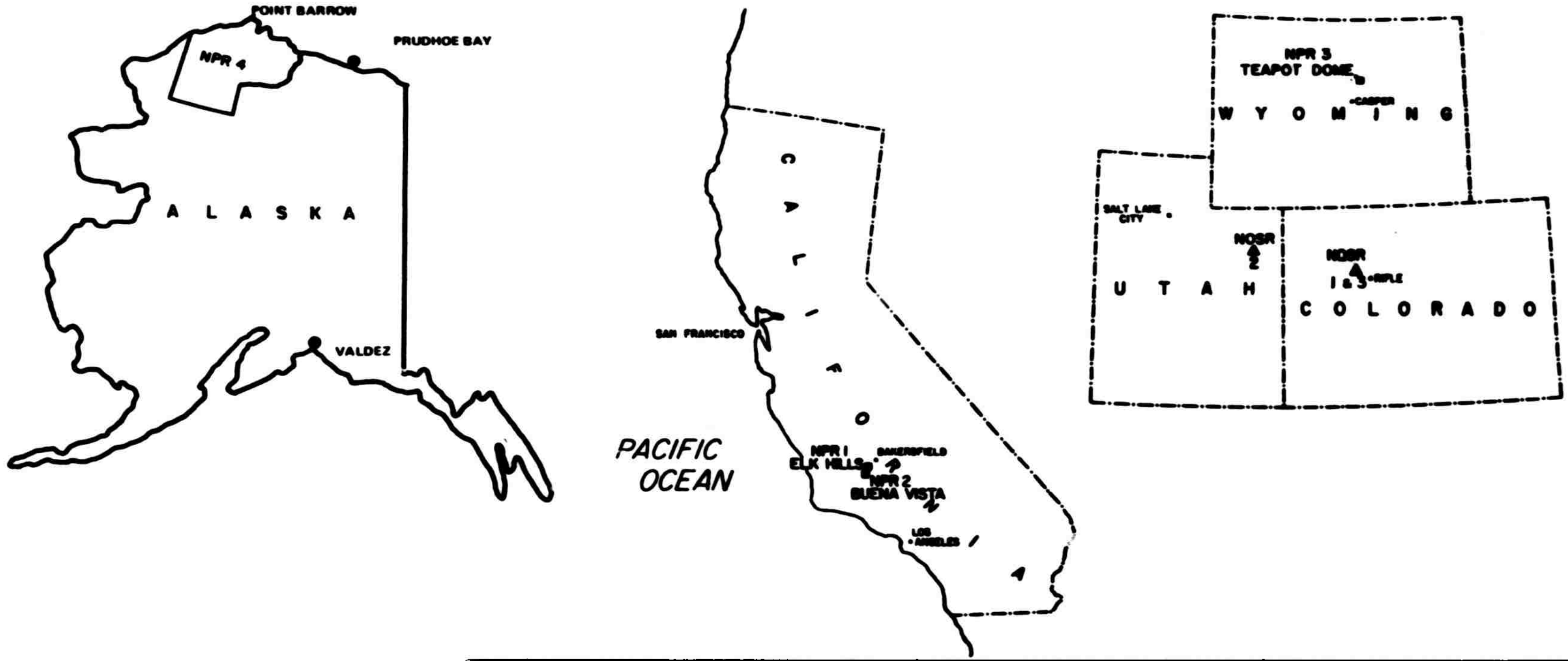


FIGURE 5-1. LOCATION MAP OF NAVAL PETROLEUM AND OIL SHALE RESERVES IN CONTINENTAL UNITED STATES

Prior to 4 June 1920, no authority existed for the exploration and development of the Reserves. However, 41 Stat. 813 of that date placed the Naval Petroleum Reserves under the authority of the Secretary of the Navy and directed him to "...conserve, develop, use and operate them for the benefit of the United States." Administration of the Reserves has remained the responsibility of the Secretary of the Navy since the enactment of this statute, except for the period from 1921 to 1927 when the Reserves were transferred to the Department of the Interior by authority of Executive Order 3473 issued by President Harding. Formal codification of the regulations concerning the administration of the Reserves was established in Title 10, U.S. Code, Sections 7421 to 7438.

As a result of certain leasing actions taken by the Department of the Interior while the Reserves were assigned to that Department and as a result of subsequent production authorized by the President and the Congress for national defense or conservation, certain portions of the Petroleum Reserves have been developed and produced. A total amount in excess of 500 million bbl of oil has been produced from NPR Nos. 1, 2, 3, and 4. However, about 1.1 billion bbl of proved recoverable oil remain in these reserves, and it has been estimated that additional significant potential recoverable reserves can be developed in NPR Nos. 1 and 4. No extensive development of the Oil Shale Reserves has been undertaken by the Navy. Therefore, reliable estimates of the total oil that could be produced from these Reserves are not available.

The following is a summary of the legislation that is applicable to the Naval Petroleum and Oil Shale Reserves.

- Pickett Act, 36 Stat. 847, June 1910. Authorized the President to make withdrawals of public lands from entry and settlement under public land laws.

- U.S. President, Executive Order, 2 September 1912. Established NPR No. 1 in Elk Hills, California.

- U.S. President, Executive Order, 13 December 1912. Established NPR No. 2 in Buena Vista Hills, California.

- U.S. President, Executive Order, 30 April 1915. Established NPR No. 3 in Teapot Dome, Wyoming.

- U. S. President, Executive Order 3797A, 27 February 1923. Established NPR No. 4 in the vicinity of Point Barrow, Alaska.

- U. S. President, Executive Order, 6 December 1916. Established OSR No. 1 in Garfield County, Colorado, and OSR No. 2 in Uinta County, Utah.

- U. S. President, Executive Order, 27 September 1924. Established OSR No. 3 in Garfield County, Colorado.

- 41 Stat. 813, June 1920. Authorized the Secretary of the Navy to take possession of the Naval Petroleum Reserves and to conserve, develop, use, and operate these reserves for the benefit of the United States.

- U. S. President, Executive Order 3473, 31 May 1921. Transferred administration of the Reserves to the Department of the Interior.

- U. S. President, Executive Order 4614, March 1927. Returned administration of the Reserves to the Secretary of the Navy.

- 45 Stat. 148, February 1928. Authorized the Secretary of the Navy to administer all outstanding leases of the Reserves.

- Public Law 87-796, October 1962. Granted the Secretary of the Navy the same authority for oil shale reserves as for petroleum reserves.

- Title 10, U. S. Code, Chapter 641, "Naval Petroleum Reserves," Sections 7421 to 7438. Established authority and responsibility of the Secretary of the Navy in administering the Naval Petroleum and Oil Shale Reserves. Section 7422 specifies that production of petroleum, gas, oil shale, and products thereof may be undertaken by SECNAV when such production is found to be necessary for national defense and such production is approved by the President and authorized by a joint resolution of the Congress.

5.3 CURRENT STATUS

The status of the Naval Petroleum Reserves as of July 1973 is summarized in Table 5-1, in which NPR No. 4 has been separated from the other three to highlight its uniqueness and significance. To permit proper interpretation of certain of the data included in the table, the following definitions are provided concerning the categories of reserves:

- Proved recoverable reserves. The estimated quantities that geological or engineering data demonstrate with reasonable certainty to be recoverable from known reservoirs under existing economic and operating conditions. In general, they include only the producible content of the explored portions of reservoirs.

- Estimated potential recoverable reserves. Reserves that geophysical data (e.g., seismic or magnetic) indicate may be recoverable from areas considered to be potentially favorable to the occurrence of petroleum hydrocarbons. These reserves are not proved and require extensive drilling to define the recoverable reserves with any degree of accuracy.

5.4 CURRENT POLICY

The following is a summary of recent pertinent policy statements concerning the Navy Petroleum Reserves.

5.4.1 Presidential Press Release of 29 June 1973

"...the organization of the Federal Government to meet its responsibilities for energy and natural resource policies has not changed to meet the new demands. The Federal Government cannot effectively meet its obligations in these areas under the present organizational structure, and the time has come to change them. ...I am, therefore, proposing today the establishment of a new Cabinet-level Department of Energy and Natural Resources, responsible for the balanced utilization and conservation of America's energy and natural resources.

TABLE 5-1

STATUS OF NAVAL PETROLEUM RESERVES

Reserve	PROVEN RFCOVERABLE RESERVES			Potential Reserves
	NPR No. 1 Elk Hills, Kern County, Calif.	NPR No. 2 Buena Vista Hills, Kern County, Calif.	NPR No. 3 Teapot Dome, Natrona County, Wyoming	NPR No. 4 Pt. Barrow, Alaska
Area (acres)	46,095	30,181	9,481	23,680,000
Proved Recoverable Oil Reserves (barrels)	1.0 billion	21 million	43 million	100 million
Estimated Gas Reserves[(1)] (MCF)	1.3 billion	50 million	8 million	Very significant[(3)]
Estimated Potential Recoverable Oil Reserves (in addition to proved reserves), (barrels)	482 million	Unknown	Unknown	Very significant[(3)]
Current Oil Production (barrels per day)	5,000	7,900	500	0
Existing Oil Production Capacity (barrels per day)	(2)	7,900	1,000	0
Estimated Max. Oil Production Capacity from Proved Reserves (barrels per day)	(2)	7,900	5,200	Very significant[(3)]
Cost to Develop Max. Oil Capacity in Proved Reserves	(2)	-	9.4 million	(3)
Time Required to Develop Max. Production Capacity in Proved Reserves (Months)	(2)	-	24	(3)

(1) Data were not developed on natural gas productive capacity, since Reserves have been developed as oil fields. It is intended that any gas produced in production of fields would be reinjected into reservoirs to maximize oil recoverability. MCF represents thousands of cubic feet at standard conditions.

(2) See Table 5-1A

(3) Department of the Navy, "Engineering Plan for Assessment and Evaluation of Naval Petroleum and Oil Shale Reserves," March 1973, estimates that total potential recoverable reserves of 10 to 33 billion bbl of oil and 80 trillion cu ft of gas and a total potential deliverable capacity of up to 3 million bbl/day of oil can be developed from NPR No. 4, based on data currently available. The plan estimates exploration and development costs will approximate $150 million and $1.9 billion, respectively, for such a program. In addition, approximately $2 billion to $3 billion in investment costs will be required for pipeline construction from NPR No. 4 to an ocean terminal. Approximately 10 years will be required to complete the full exploration, development, and construction program on an expedited basis.

Source: Office of the Naval Petroleum and Oil Shale Reserves, Fact Sheet, dated 23 July 1973; and Department of the Navy, "Engineering Plan for Assessment and Evaluation of the Naval Petroleum and Oil Shale Reserves," March 1973.

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TABLE 5-1A

NAVAL PETROLEUM RESERVE NO. 1

Estimates of Production/Deliverability Capabilities

	Present Sustained Capability	5 Yr SECNAV Readiness Requirement (1967)	Maximum Sustained Production from Proved Resources	Maximum Sustained Production from Further Exploratory/Development (1)
Production (BPD)	100,000	160,000	267,440	755,000
Days/Mo to achieve	60 Days	60 Days	60 Months	120 Months
Transportation	100,000 BPD available internally to Reserve boundary. Short 75,000 externally but consider commercial augmentation will be available within 60 days.	Would expand to 160,000 BPD internally to Reserve boundary. Short 135,000 externally but consider commercial augmentation will be available up to 120-140,000 BPD in 60 days. Additional capacity to 160,000 BPD will require added time and funds.	Would expand to 267,440 BPD internally to Reserve boundary. Shortfall of about 242,000 BPD external to boundary; will have to be augmented commercially, and can be done during oil production build-up.	Would expand to 755,000 BPD internally to Reserve boundary. Shortfall of about 730,000 BPD external to boundary; will have to be augmented commercially, and can be done during oil production build-up.
Cost (Date of estimate)	$2M start-up cost (11/73)	$21.6M capital cost (10/72)	$69M development cost (10/72)	$309M development cost (4/73)

(1) Department of the Navy, "Engineering Plan for Assessment and Evaluation of Naval Petroleum and Oil Shale Reserves," March 1973, estimates that an additional 482 million bbl of recoverable reserves and 492,000 bbl/day of productive capacity can be developed in NPR No. 1 within 10 years at a total estimated cost of $19 million for exploration and $290 million for development.

"The Department of Energy and Natural Resources would take charge of all the present activities of the Department of the Interior... It would also assume the responsibilities of the Forest Service, certain water resources activities of the Soil Conservation Service...; the planning and funding of the civil functions of the Army Corps of Engineers; the duties of the National Oceanic and Atmospheric Administration of the Department of Commerce, the uranium and thorium assessment functions of the Atomic Energy Commission, the functions of the interagency Water Resources Council, and gas pipeline safety functions of the Department of Transportation."

This statement is considered significant in its silence concerning the Naval Petroleum and Oil Shale Reserves.

5.4.2 Comments in Letter from General Counsel, Department of Defense, to Senator H. M. Jackson*

- DoD supports the concept of maintaining a national petroleum reserve of crude oil and refined products.

- Naval Petroleum Reserves, when fully developed, can make a significant contribution to national security as standby production capacity.

- Production of Naval Petroleum Reserves should be undertaken only in accordance with provisions of Chapter 641, Title 10 U.S. Code; that is, when "it is needed for national defense and the production is authorized by a joint resolution of Congress."

5.4.3 Remarks by President Nixon on the Nation's Energy Policy, 8 September 1973

- "...developing the Elk Hills Reserves (NPR No. 1) is essential in terms of providing from our domestic sources, for the needs that we have."

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* General Counsel, Department of Defense, Letter of 25 July 1973 to Senator H. M. Jackson, subject: "Senate Bill 1586, a bill to create a system of strategic petroleum reserves and other purposes."

- "And consequently, we are moving next week in the consultative process (with Congress) so that we can go forward with the Elk Hills development."

5.4.4 Memorandum from Chairman, Joint Chiefs of Staff, the Secretary of Defense, dated 12 October 1973

- Objects to production of NPR for other than defense purposes.

- Would, however, support limited production if determined to be required by the President during a national emergency.

5.4.5 Statement of Rep. F. E. Hebert, Chairman, House Armed Services Committee, 17 October 1973

"These reserves are protected by the provisions of law set forth in Chapter 641 of Title 10 of the United States Code. These provisions were basically established by that great former Chairman of the Armed Services Committee, Mr. Carl Vinson. He left no doubt in anyone's mind that those reserves were to be used only in the defense of our country.

"...the Naval petroleum reserve had been considered by those charged with its safekeeping as a national asset to be held in trust— an asset not to be frittered away."

5.4.6 Statement by Secretary A. I. Mendolia, ASD(I&L), before Hearings of the House Armed Services Committee, 17 October 1973

"...After review of anticipated oil industry developments in the reasonably foreseeable future, it is our conclusion that the Congress can, with careful control, allow temporary use of the reserve (NPR No. 1) probably not in excess of five percent of the producible oil, for a proven national oil emergency to alleviate hardship, without serious jeopardy to the availability of the reserves for military petroleum needs in some future emergency.

"...Under these conditions, it does not appear unreasonable to look to the Nation's defense oil reserves for help, particularly if

temporary production of those reserves will not impair their continued role as a viable defense asset.

"With minor revision of existing legislation governing use of the Naval reserves, the way can be paved for limited application of reserve producing capacity to valid non-military emergency civilian needs. The Department of Defense stands ready to work with the Congress on this important matter, in full recognition that care must be exercised to insure adequate safeguarding of the reserves.

"...Production of additional oil from Elk Hills can help alleviate hardship resulting from fuel shortages, and for that reason the Department of Defense supports the President's proposal for temporary production from the reserve."

5.5 RELATED ACTIONS CURRENTLY UNDERWAY

The following recent actions relating to the Naval Petroleum Reserves are considered pertinent to this analysis.

5.5.1 GAO Report B-66927 of October 1972

The GAO report recommended that the Secretary of the Navy, with the approval of the President, should:

- Determine reserves and productive capacity of Naval Petroleum and Oil Shale Reserves

- Submit to Congress a plan for the adequate development and conservation of the Reserves.

The Secretary of the Navy, in a letter of 29 June 1972, informed GAO of his concurrence with the GAO recommendations and indicated that the Navy would submit a development proposal within a reasonable period of time. On 3 April 1973, the Secretary of the Navy submitted an engineering plan for assessment and evaluation of the Naval Petroleum and Oil Shale Reserves to the President for his approval and subsequent submission to the Congress for authorization and funding. The Secretary of the Navy indicated in his letter to the President that a plan for the development and conservation of these reserves would be submitted upon completion of the evaluation. The assessment plan provides for the exploration and full development of NPR No. 1,

evaluation of the extent of reserves contained in NPR No. 4, and preliminary plans for development of the Naval Oil Shale Reserves. The plan is currently under evaluation by the Energy Policy Office. The objectives and general approach of this plan appear to be sound. However, the Defense Energy Task Group could not fully evaluate the adequacy of the proposed plan and considers that further extensive, detailed engineering analysis will be needed before a major commitment of funds can be made.

5.5.2 Creation of the Department of Energy and Natural Resources

President Nixon's proposal for the creation of the Department of Energy and Natural Resources (DENR), which would be responsible for balanced utilization and conservation of all energy and natural resources, was submitted to the Congress on 29 June 1973. Hearings have been conducted by both the Senate and the House, and additional hearings by the House are scheduled.

5.5.3 Hearings on Increased Production in NPR No. 1

As announced by the President on 8 September 1973, the Administration intended to consult with the Congress concerning increased production in NPR No. 1. Hearings on this matter were conducted by the House Armed Services Committee on 17 and 18 October 1973. The hearings did not result in the initiation of authorizing legislation. In his Energy Address to the Nation on 7 November 1973, the President again stated the need to utilize NPR No. 1 to help alleviate the current energy crisis.

5.5.4 National Emergency Petroleum Act of 1973

On 18 October 1973, Senator Jackson introduced this bill, S. 2589. The Act would, inter alia, authorize the President to produce the currently developed resources in the Naval Petroleum Reserves. It would also require expeditious exploration and further development to determine total recoverable reserves and make possible their production at, or in excess of, their maximum efficient rate of production. The bill authorized appropriation of $150 million for all the purposes of the Act. Hearings were conducted by the Senate Committee on Interior and Insular Affairs on 24 October 1973 and further hearings were held starting on 8 November 1973.

5.6 U.S. PETROLEUM RESERVES AND REQUIREMENTS

Proved oil reserves in the United States total 43 billion bbl. As discussed in Chapters 1 and 2, the Department of the Interior projected that U.S. energy demand will increase at an average rate of 3.8 percent/year during the period from 1971 to 1985. Petroleum demand during the same period is projected by the National Petroleum Council to more than double and reach a level of 30 million bbl/day or 11 billion bbl/year in 1985. Imports are expected to supply up to 65 percent of this total, approximately 19 million bbl/day, in 1985. Projected U.S. and DoD petroleum requirements are shown in Table 5-2.

The lead times required to develop significant capacities for any alternate domestic petroleum energy sources are substantial and in some cases reach to the 1990's. Accordingly, it is imperative that additional resources capable of producing significant quantities of energy with existing technology be developed to full productive capability as rapidly as possible.

Historically, funds have not been available in the DoD budget to provide for the full exploration and development of the Naval Petroleum Reserves. The Office of Naval Petroleum and Oil Shale Reserves estimates that a total of $4.3 billion to $5.3 billion would be required over a 10-year period to develop the full estimated productive capacity of 3.8 million bbl of oil per day from the Reserves. This assumes certain probabilities of success which may or may not prove valid. However, the rapidly increasing risks associated with investments by U.S. oil companies abroad may make it possible to develop a contractual method whereby qualified U.S. oil firms would undertake, at no or minimal direct cost to the Government, the exploration and development of high potential areas in the Naval Petroleum Reserves. Such contracts would provide, under supervision of the Navy, for the exploration and development firms to participate later, on an equitable basis to be agreed on, in the production of the Reserves should such production be authorized by the President and the Congress. The employment of such a contracting technique would require Presidential and congressional approval in accordance with Title 10, U.S. Code.

Total proved recoverable reserves of oil in the Naval Petroleum Reserves are not adequate to satisfy projected military requirements for a 3-year general war. Moreover, the total estimated deliverable capacity attainable from the proved recoverable reserves, even if fully developed, would not be adequate to supply required wartime rates of 1.2 million to 1.6 million bbl/day. However, information concerning the potential petroleum reserves of the North Slope

TABLE 5-2

U.S. AND DOD PETROLEUM REQUIREMENTS

Sector	Requirements (Millions of Barrels per day)			Cumulative Requirements (Billions of Barrels)		
	CY73	CY80	CY85	1973	1973-80	1973-85
U.S.[1] (incl. DoD)	17	25	30	6.2	60.2	111.3
DoD[2, 3, 4]						
Peacetime						
Army	.06	.06	.06	.02	.16	.26
Navy	.22	.23	.23	.08	.65	1.08
Air Force	.38	.36	.36	.14	1.08	1.74
Total	.66	.65	.65	.24	1.89	3.08
Percent of U.S.	(3.9)	(2.6)	(2.2)	(3.9)	(3.1)	(2.8)
Wartime	Average Daily (millions of barrels per day)			Total (millions of barrels)		
	D to D + 30	1.6		1-year General War — 450		
	D + 31 to End	1.2		2-year General War — 888		
				3-year General War — 1326		

[1]Source: National Petroleum Council, December 1972.

[2]Peacetime requirements for DoD, based on DFSC Report DD-I&L(Q) 504, Service Projections for CY73 Consumption. Assumes net decrease in consumption in CY74 and no net change in consumption thereafter.

[3]Approximately 50 percent of DoD procurement in FY73 was obtained from foreign sources. Approximately 80 percent of this volume was procured from the Middle East. These relationships are expected to continue (barring major interruptions, denials, or force redistributions) for the short- and mid-range periods.

[4]Wartime requirements for DoD, based on DFSC Report DD-I&L(A) 505, Wartime Petroleum Planning Data, FY74, and JCS Strategic Stockpile Guidance Paper, dated 27 March 1972, which established strategic stockpile objectives as 3 years of wartime requirements.

of Alaska, which includes both the recent massive reserves developed at Prudhoe Bay and NPR No. 4, indicates the possibility of developing adequate deliverable capacity in NPR No. 4 to fully satisfy DoD wartime requirements. Mr. W. D. Hamm, retired Executive Vice President for Worldwide Exploration and Production of the Atlantic Richfield Co. and now a private consultant, who was in charge of the exploratory operations that led to the Bay discovery, stated in discussions with the Defense Energy Task Group on 2 November 1973 that:

"Naval Petroleum Reserve No. 4 is located in the Arctic geologic basin which, perhaps, contains greater undiscovered oil and gas potential than any other basin.

"In the area adjoining NPR No. 4 on the east, the Prudhoe Bay oil and gas field, which is one of the largest fields on the North American continent and has a high rate of deliverability, has been developed.

"On NPR No. 4, wells have been drilled and oil and gas have been found in relatively shallow sands but, in this remote location, are not now of economic significance. The outcrops of rocks in Brooks Range on the south side of NPR No. 4 contain extensive sections of rocks from Cretaceous Age to Cambrian which, together with evidence elsewhere, would suggest multi-pay potential for prospects in NPR No. 4.

"Prudhoe Bay is producing almost entirely from Triassic sands which were really not considered as the major objective at the time the discovery well was drilled. The underlying carboniferous Devonian section which at the outcrop contains porous reefs with evidence of oil, was the potential objective prior to discovery; and these deeper formations probably will be productive here and elsewhere on the North Slope.

"In the Siberian portion of the Arctic Basin, extremely large reserves have been found in the rocks of Cretaceous to Cambrian Age. A point of interest here is the fact that most explorationists have disregarded the older formations, including Cambrian, which are now becoming productive. Westward from NPR No. 4, oil companies have conducted geological and geophysical studies which indicate areas of interest and the U. S. Geological Survey, shooting in the Chukchi Sea, has found prospects considered favorable for oil and gas.

"Additionally, very substantial gas and some oil have been discovered in the Arctic Islands. The point I wish to make here is that

NPR No. 4 is located in a large petroliferous basin where oil may be discovered in a number of different horizons. Prospects, no doubt, will include the conventional types of anticlines together with more complicated structures and stratigraphic traps.

"In summary, NPR No. 4 should be classified as being one of the most attractive exploratory areas."

The omission of the Naval Petroleum Reserves from the proposal to create a Department of Energy and Natural Resources implies an intention by the President to retain their administration in the Department of the Navy. The opening statement by Chairman Hebert at hearings on 17 October 1973 indicated influential support for this position in the Congress. Accordingly, it is important that the Office of Naval Petroleum and Oil Shale Reserves be adequately staffed to administer a contractual program of the significance and complexity envisioned.

5.7 CONCLUSIONS

- Existing producing capacity is not adequate to satisfy defense requirements for either peace or general war conditions. Maximum estimated potential capacity from the proved recoverable reserves, primarily from NPR No. 1 with small contributions from NPR No. 2 and 3, is estimated to be about 280,000 bbl/day. It would take about 5 years to develop such resources. Significant potential reserves may be available from NPR No. 4 and could be adequate to satisfy DoD requirements in 7 to 10 years. Exploration and development of the full productive capacity of the Naval Petroleum Reserves is, therefore, important to the national security of the United States (see Figure 5-1 and Tables 5-1 and 5-1A).

- Funds estimated at $4 billion to $5 billion (of which about $69 million are needed for NPR No. 1 and the remainder for NPR No. 4) have not been available in the DoD budget to support the exploration and development of the full productive capacity of the Reserves over the 10-year period required for such a program. Moreover, any funds realized from necessary production of the Reserves for conservation and readiness purposes are not available to finance further development of the Reserves.

- The significant exploration and development costs of NPR No. 4 may make it desirable for the Government to consider participation by industry in such an undertaking.

5.8 RECOMMENDATIONS

5-1. The Secretary of the Navy, with support from the Secretary of Defense, should more fully develop the scope and depth of analysis required to support the "Engineering Plan for the Assessment and Evaluation of the Naval Petroleum and Oil Shale Reserves," dated March 1973.

5-2. The Secretary of the Navy, with support from the Secretary of Defense, should pursue the funding and staffing for the administration of an accelerated program of contractual exploration and subsequent full development of potential reserves of the Naval Petroleum Reserves through the normal budget processes.

5-3. If necessary funding and staffing to support full contractual exploration and development of the Reserves cannot be obtained through the normal budget processes, the Secretary of the Navy should pursue the development of a procurement strategy that will permit industry participation in the exploration, development, and production of the Reserves. The development of such a methodology would require:

- The approval by the Congress of legislation, or the establishment of congressional intent through hearings on such legislation, which would commit the Congress, upon completion of full exploration of the Naval Petroleum Reserves, to authorize the development and production of any oil and gas reserves developed in the Reserves which are in excess of defense requirements, as defined by the Department of Defense. Any such production would necessarily provide for a fair rate of return to be agreed on by the Government and the participating contractors.

- The definition of the procedural aspects of such a method should, as a minimum, provide for:

  - Definition of the scope of the program of exploration required by the Government.

  - Requests for submission by interested firms or consortiums of statements of interest in and proposed technical approaches to the program proposed by the Government. Evaluation of the feasibility and limitations of the program proposed by the Government should be solicited.

  - Establishment of a board of qualified DoD technical, legal, and contractual personnel to review proposals, develop a definitive contractual package, and select those firms or consortiums to whom a request for a detailed technical proposal should be directed.

  - Review by the evaluation board of all proposals to determine those that are technically and economically responsive, and development of a recommendation for award or negotiations leading to an award.

  - Provision for collection and analysis of exploration data developed by the contractors at their own expense.

  - Submission of the foregoing data by the Secretary of the Navy to the Congress for its authorization for further development, production and conservation as defined in earlier congressional authorization.

5-4. The Secretary of Defense should request the Secretary of the Navy to conduct an analysis of the Naval Oil Shale Reserves similar to the one accomplished by the Defense Energy Task Group for the Naval Petroleum Reserves.

CHAPTER 6

DEFENSE ENERGY CONSERVATION

6.1 INTRODUCTION

This chapter summarizes the efforts of the Defense Energy Task Group to investigate existing energy conservation programs within DoD, and to identify specific actions that will increase the effectiveness of those programs.

6.2 DETG CONSERVATION STUDY PLAN

For a long time, there have been energy conservation programs in the Armed Services primarily directed toward cost savings in the facilities area, but the support has varied considerably from year to year. Until now, there has never been a consolidated study to determine the extent and effectiveness of these programs from a DoD viewpoint in both the facilities and the operational areas. The conservation portion of the Defense Energy Task Group's effort was to review existing instructions, directives, and programs; to evaluate the comprehensiveness of this guidance; and to measure the application of the guidance in the field. Using the results of this initial study and additional research and field surveys, recommended changes were developed in current conservation guidance and identification of programs which would contribute to more efficient energy usage.

To attain these objectives, the DETG first reviewed in detail all current DoD and headquarters-level Service directives relevant to the energy conservation. To gain a better appreciation of the overall effectiveness of Service programs and stimulate interest in the limited time available, sample field surveys were conducted at one Air Force installation, one Navy installation, two Army installations, one Marine Corps installation, and a Government-owned, contractor-operated plant. In addition, three Navy ships in the San Francisco Bay areas were surveyed and Pacific Fleet Type Commanders were interviewed. These surveys were conducted.to review current directives with the field commanders, to measure the degree of implementation of these activities at the operator level, identify operational constraints, and to surface new concepts and ideas appropriate

for DoD implementation. Included in this category were not only short-range concepts and ideas but also long-range needs that were appropriate for R&D programs, and others requiring study beyond the scope of the DETG. The field surveys, though limited, are believed to be representative of the degree of conservation awareness and effort at the installation level.

In order to impress the Services with the urgency of the situation and importance of energy conservation, it was decided to launch the DETG conservation campaign with a pilot seminar in the San Francisco Bay area where a large group of representative DoD facilities were located. It was decided to hold a second seminar on the east coast to indoctrinate as many Service personnel responsible for subordinate command programs as possible in an effort to shift the primary responsibility for the conservation effort to the Services.

6.2.1 Pilot Seminar

The DETG's seminar program was designed to present factual information on the DoD energy problem and to provide a forum for the interchange of energy conservation ideas among the Services. A logo and slogan (see Figure 6-1) were developed and used. The pilot seminar was conducted on 1 October 1973 in San Francisco, California, with 88 attendees from all Services, including 19 General/Flag Officers.

The seminar consisted of DETG presentations on the energy problem and two presentations by each Service: one on installation conservation and one on operational conservation measures.

The most successful conservation programs were at installations where the commander took an active personal interest and established an energy conservation board to manage and monitor the program. One installation had appointed, in addition to a central group, eight committees — one for each major utility system.

Some installations had taken the initiative to establish programs without waiting for guidance from higher headquarters. As an example, one installation set up temporary storage facilities, utilizing obsolete collapsible bags from its tactical fueling system and rail cars on a loan basis. Many similar conservation actions can be accomplished within an installation's own resources and capabilities. In general, all Services had long-standing utilities conservation programs that were receiving added emphasis.

SAVE
DEFENSE
ENERGY

FIGURE 6-1. LOGO AND SLOGAN FOR DETG SEMINAR PROGRAM

6.3.1 Department of Defense

The OSD direction in energy conservation has been oriented generally toward establishing criteria for the construction, maintenance, and operation of real property and implementation of the President's 7 percent conservation program. In the real property area, DoD Construction Criteria Manual 4270.1M deals with design criteria and equipment selection, and establishes standards for cost studies to justify type projects. Energy conservation is not directly addressed, but design criteria inherently address efficiency and controls that would result in energy conservation. Very little direction has been given for energy conservation in operating aircraft, ships, and ground equipment except as derived from budgetary limitations.

DoDD 4165.2,: "DoD Real Property, Maintenance Activities Program," establishes general guidelines on conservation of utilities and concentration of activities in the minimum number of facilities at an installation. The primary responsibility for reducing energy consumption, however, rests with the Services.

Additional DoD guidance for real property utility systems issued recently include:

- 1 August 1973 ASD(I&L) Memorandum containing a series of energy conservation requirements covering building orientation, use of glass in buildings, use of special thermostats, and use of high-efficiency low-electric input water heaters and window air conditioning units. Included was the requirement to make life-cycle cost studies based on double the FY72 utility cost.

- 17 July 1973 DepSecDef Memorandum implementing the President's 7 percent conservation program and establishing conservation goals by fuel type and a follow-on reporting procedure.

- 14 September 1972 ASD(I&L) Memorandum directing each Service to develop specific plans to increase efficiencies of heating plants and systems.

- 30 May 1972 ASD(I&L) Memorandum advising all military departments of the necessity to conserve electric power as well as other forms of energy.

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6.3.2 Service Conservation Programs

The major emphasis in past Service conservation programs was also directed toward installation support functions with only generalized good management practices encouraged within each Service for operational conservation. In both areas, conservation programs have languished because of the lack of resources and command emphasis.

The publication of various DoD memorandums in 1973, emphasizing the possible fuel shortage and energy conservation measures, motivated the Services toward reestablishing and expanding their conservation programs to include all users of energy, including tactical ground ships and air operations.

Construction of new facilities has, in general, been controlled by space criteria and available funds. The necessity to relate the design of projects to energy availability or conservation has been given low priority, and in general, the emphasis on first cost has virtually eliminated life-cycle costing as well as energy conservation from consideration.

6.4 SURVEYS

As previously noted, after the pilot Defense Energy Conservation Seminar held in San Francisco on 1 October, the Conservation Survey Team visited five representative west coast installations. Air operations were emphasized during this pilot survey to address the area of largest DoD energy use, emphasize the impending west coast shortage of JP-5 jet fuel, and maintain a commonality of installation types across Service lines for this initial study. Two Army bases provided survey information on ground equipment operations. Ship operations conservation programs were surveyed by meetings with Pacific Fleet Type Commanders in San Diego and visits to three ships in the San Francisco Bay area.

To maintain uniformity and make the limited time more fruitful, survey checklists were developed and used during the installation visits. As previously noted these checklists have been provided to seminar attendees and the Services for assistance in continuing programs. It is anticipated that these checklists will serve as guides for Service managers and installation commanders in addressing conservation efforts and applying available resources in potential high payoff conservation areas.

The following is a brief review of the effectiveness of current command conservation programs identified during these surveys. Although the sample size of installations was small, it is considered that a reasonable estimate of DoD-wide attitude can be inferred.

6.4.1 Installations

6.4.1.1 Management and Base Usage

Management of the energy conservation program was characterized by an obvious recent surge of interest. The degree of awareness and interest was directly proportional to the commander's involvement in the program. Command-level awareness was apparent, but the need for energy conservation was not generally understood at lower echelons. Considering the comparatively recent emphasis on energy conservation, this lack of understanding at subordinate levels was not surprising.

On the operations side, POL reductions were established by reduced allocations of POL products, reduced flying hours, or reduced steaming days. This area was under positive control with allocations normally made to user level. Although some concern was expressed on the impact on readiness of reduced fuel allocations, a positive attitude was apparent. Necessary adjustments in training and operational procedures had been developed and were being implemented. Nonpetroleum use showed a general lack of positive control measures.

Implementation of positive control measures and completion of programmed and projected conservation measures are being hampered by funding and personnel constraints. The currently existing backlog of projects that would assist the conservation effort will increase in the future if these constraints are not relaxed. Most importantly, however, energy conserving projects merit higher priority than is being accorded them in current program planning.

Comprehensive emergency plans to phase down installation operations in the event of an actual reduction or stoppage of energy supply had not been developed. The probability of such occurrence is high enough to warrant contingency planning to reduce uncertainties and to establish explicit procedures.

A general tendency toward "business as usual" attitudes was visible in several instances. On the other hand, a number of innovative and meaningful energy conservation methods and procedures had been implemented or were under consideration.

6.4.1.2 Utilities and Procurement

The conservation effort in the utilities area varies considerably. Some facilities surveyed had good programs at the staff level. Generally, at the working level personnel did not appear to have been notified of the importance of the program. All installations indicated that the Presidential goal of a 7 percent reduction in utilities would be met. However, it was not always apparent at the working level that any extraordinary effort was being made to meet the goals. Except in a few instance, personnel working in the utility area were not informed of the OSD published program to survey all heating plants and systems for possible improvement in operational efficiencies.

The conservation plans produced by the installations, if implemented at the working level, would be effective. Included were provisions to turn off parking area lights and airfield lighting systems in early morning hours, consolidate facilities, install night setback temperature control systems, and consolidate heating plants for summer operations. However, their programs did not include incentive plans for utility system operators that would motivate them to operate their systems more efficiently. Problems in accomplishing some of the programs, such as leak detection and boiler inspection programs, were curtailed owing to lack of personnel and resources. Monitoring of utility use is difficult without meters to measure consumption. Gas and electricity are usually metered only at one or two points of the installation, and portable instrumentation was not observed in use at any of the installations surveyed. When required for engineering analysis, effective monitoring of energy use can be accomplished with portable meters.

A serious deficiency noted was the failure to return steam condensate to the boilers. At one installation the condensate loss was at times as high as 30 percent of the total boiler output.

The procurement of utilities is accomplished generally as a routine matter. Rates are reviewed annually. There is a lack of expert rate engineers at the command level to negotiate with the utility companies. Joint Utility Service Boards, made up of representatives of

local DoD and GSA facilities for geographical areas, meet periodically to discuss items of mutual interest; but it was not intended for these boards to negotiate directly with the utility companies.

6.4.1.3 Programming, Construction, and Design

During the survey of sample installations, it was generally found that programming, design, and construction support had not been directed toward energy conservation. The following specific observations were made.

Programming for capital investment in the construction of new utilities facilities follows far behind the priority of pollution abatement, operation and tactical facilities, bachelor and family housing, and all other missions. There is no evidence that construction is programmed primarily to conserve energy.

The installation commander establishes his construction priorities, which are reviewed and compiled into an integrated list through various echelons of command. Upon approval to proceed, the basic and detailed design is provided by the Army Corps of Engineers, the Naval Facilities Engineering Command, or the Air Force Civil Engineer elements with in-house personnel, or by contract. The installation commander does not normally have an adequate staff to render technical review for energy economy. His primary concerns are location, aesthetics, and operational adequacy.

The criteria for military construction (MILCON) are based on occupancy standards such as dollar limitations per person or square feet per person. These criteria are in all cases related to cost limitations in the Military Construction Program presented to the Congress, and the time lag from fund appropriation to contract award may require redesign to stay within the funds authorized. The reduction of costs normally can be achieved only through a relaxation of standards, which can preclude such measures as double glazing of windows and effective insulation. The curtailment of these features results in higher consumption of energy for heating, air conditioning and hot water in new facilities.

Construction of the facilities is supervised by the Army Corps of Engineers, the Naval Facilities Engineering Command, or the Air Force Civil Engineer elements. The completed facility is turned over

to the installation commander, who had little voice in the redesign that might have been imposed to stay within cost limits.

There is an alternative action available to the installation commander to obtain Urgent Minor Construction funds up to $300,000 without a certificate of urgency if the expense can be amortized within a 3-year period. There are, however, few instances when similar work on similar facilities can be done within the $300,000 cost limit. Consequently, the prohibition against incrementation precludes accomplishing the work under this program. This also applies to self-help projects if the funded cost exceeds the $300,000 limit. For example, 10 boiler plants could be more efficient with automatic controls costing $40,000 per plant. The total cost would be $400,000, which is over the $300,000 limit. To accomplish the work on one-at-a-time basis would be considered incrementation.

Some improvement work is accomplished in conjunction with major repair. The Services need to emphasize the necessity to incorporate energy conservation in the specifications for major repair. A specific example is the replacement of a heating system in a building which should include proper thermostat controls.

Installation commanders have some prerogatives in programming facilities that will conserve energy, but the relative priority has been historically so low that, under current criteria, the probability is that the line item will be deferred by intermediate commands, the Office of the Secretary of Defense, or the Congress. Unless current priorities in MILCON appropriation, cost limitations, and repair criteria are modified, the installation commander can do little to accomplish major facility construction, replacement, or repair actions to effect significant energy conservation.

In view of the fact that the installation commander has little input to the construction criteria of new facilities, construction conservation actions should be directed primarily toward the agencies responsible for the design and construction. At present, these agencies give primary consideration to minimizing first costs, which does not, under current guidance from DoD, conserve energy or take maximum advantage of the energy most readily available.

The low priority for funding energy conservation projects, in spite of potential or rapid payback, has contributed to the degradation of utility systems at DoD installations. An effective way to improve

this situation would be the establishment of a revolving capital fund. This fund, once established with congressional approval, would be reimbursed directly from savings in Operation and Maintenance funds by the installation receiving project support.

There is a very strong need to eliminate World War II and other temporary construction from the inventory. These facilities are energy intensive. From a practical standpoint, it has been found to be very difficult to tear down old structures after a new facility has been occupied. There is a problem of people spreading out to use any and all space available. Also, there is a long list of morale, social, and welfare organizations that always have a tendency to expand into any space available.

Similar effort is needed to consolidate activities on all installations. Strict space criteria need to be reevaluated. Temporary buildings thus freed should be dismantled, and unused permanent structures should be completely mothballed with all utilities disconnected. Maintaining electrical service and heating empty buildings to a 40°F level is very wasteful.

It is important to realize that, other than in complete base closure, reductions in base population will not have a directly proportional reduction in utilities costs or energy use. All basic utility systems and plants generally remain in operation to support the remaining personnel. With few exceptions, utility systems and plants are not designed to be cut off by sections or operated efficiently at partial loads. In fact, all utility systems are less efficient at part load, so the unit cost increases.

6.4.1.4 Installation Motor Transportation

Transporation Motor Pool (TMP) vehicle control manuals and local supplements on energy conservation were readily available at the consolidated motor pools, and energy conserving maintenance measures were generally being employed at the installations surveyed.

Control of general-purpose vehicles (administrative and small) and special-purpose vehicles (large maintenance) was being implemented in the form of a computerized system at one installation. In this system, each support agency on the base is assigned a certain number of vehicles. Records of gas consumption, mileage, oil, and maintenance costs are recorded and reviewed by Vehicle Control Officers at the motor pool, and records for each vehicle are then forwarded to each agency for review.

Another installation was using gasoline rationing as a means of vehicle control. Each unit is allocated a designated quantity of fuel on a monthly basis. If and when that quantity is exceeded, that unit receives no more fuel for the remainder of the time period. At another base, gasoline coupons were issued; when the coupons expire, so does the gasoline.

Most bases have reduced the number of vehicles in their fleets. The cutbacks mean fewer recreation and nonmission trips. On-post trips are being consolidated at most installations, and off-post trips are being consolidated with other bases within close proximity. Commercial transportation and bus shuttle service are utilized in most areas to discourage private vehicle use.

Vehicle (both special- and general-purpose types) operators' training programs were evident at one installation along with Standard Operating Procedures, which include instructions for the drivers to check tire pressure, check for any extra pickups, avoid "jack-rabbit" starts, and choose the most direct route to accomplish the mission.

In the maintenance area, one base has recently purchased diagnostic test equipment and is performing general-purpose tune-ups every two months along with regular annual major motor tune-up.

Special-purpose and general-purpose vehicle operators at one base had up-to-date conservation instructions and appeared conscientious in carrying out these orders, but at another installation the general-purpose operator was not aware of any conservation requirements although instructions were readily available at the vehicle control shop.

At most installations, sufficient guidance on vehicle control and proper maintenance was in evidence. However, the implementation of this guidance requires emphasis.

6.4.1.5 Government-Owned, Contractor-Operated Facilities

Government-owned, contractor-operated (GOCO) industrial facilities were recently requested to comply with the goal of reducing Federal Government energy consumption by 7 percent. A DETG survey team visted a GOCO facility in Baltimore, Maryland, to get a sample assessment of progress. Fuel conservation appeared to be receiving proper emphasis at the managerial level. A program to study the efficiencies of process equipment had been initiated, and actions were being planned to reduce energy consumption.

6.4.2 Readiness and Mission Accomplishment

The Defense Energy Task Group found no evidence to indicate that either the Joint Chiefs of Staff or the individual Services have quantified the adverse impact on readiness and mission accomplishment which would result from reductions of energy resources. It is imperative that this essential information be developed so that DoD can accurately portray its requirements and ensure adequate representation for allocating national energy resources.

6.4.2.1 Tactical Ground Operations

At the installation level, the impact of fuel shortages on mission accomplishment and readiness was of primary concern. The Army-directed 10 percent reductions in 1973 fuel allocation levels had been staffed, and instructions issued to meet the reduction objective.

Unit-level allocation, in most instances, was established by historical usage, unit commander evaluations, and known and projected requirements.

Reduced usage of tactical vehicles was an integral part of fuel conservation plans. Movement of heavy equipment to and from training areas was minimized by leaving this equipment in place until completion of the scheduled training. In some instances, equipment was exchanged between active and reserve component units to eliminate unnecessary movement of organizational equipment to a training site, but this energy-saving practice was not universal.

6.4.2.2 Air Operations

Fuel conservation efforts in air operations varied considerably between the installations visited. Flight profile planning on one base was meticulously developed by computer to determine, among other things, the optimum fuel load. Several installations showed high command interest in conservation of fuel in flight operations, with detailed instructions for flight planning, training missions, and ground operations. Other installations had only a moderate command interest with a minimal conservation effort. Some observed problems were as follows:

- At one installation, JP-5 fuel from defueling operations was considered contaminated and could only be used for ground support equipment.

- Dumping of fuel was reported for carrier aircraft training on shore.

- Pilots were flying more than necessary by maintaining currency in several aircraft types.

- Excessive staff flying.

6.4.2.3 Ship Operations

Conservation emphasis in ship operations was observed primarily through a sample survey of three ships in the San Francisco Bay area by the Director, DETG, and by discussion with the Pacific Fleet Type Commanders at San Diego. Each ship visit involved about an hour's discussion with the commanding officer and his heads of departments followed by a brief tour of the ship, including the principal machinery spaces. Each commanding officer had been provided in advance with the DETG conservation checklist for ship operations and was prepared to discuss its application to his ship. The following observations summarize general impressions of these visits.

Naval ships are essentially "total energy systems", having all energy needs centrally supplied from the ship's own fuel supply, with extensive application of waste heat recapture that has evolved from years of developmental engineering aimed at maximizing ship endurance. The goals of shipboard energy conservation are generally the same as those of power plant engineering efficiency. With proper maintenance (e.g., elimination of leaks and correction of insulation damage) and with careful operation of the main propulsion plant and distribution systems (electricity, heating, air conditioning, and the like), a ship should, at the same time be an efficient engineering entity and be prudent in the use of its fuel. However, energy conservation in the use of distributive systems is not generally practiced. Reestablishment of Fuel Economy Competition within ship classes is clearly indicated as a means of achieving increased fuel economy.

The Commander in Chief, Pacific Fleet, through his ALPACFLT 22, 112221Z Feb. 73 message, on whose application each ship appeared to be well versed, has established a well-strucutred program improving among other things, ship material readiness while reducing steaming hours (e.g., from about 60 to 30 percent times at sea for EASTPAC ships). Greater meaning could be given to this program by relating it to energy conservation as well as to its other appropriate goals because of the current national awareness of energy shortages. Older ships, with congested machinery spaces that have had many hard years of steaming, need more emphasis than the newer vessels whose equipment is more readily accessible and easier to keep in good condition.

The details of procedures used in underway replenishment of JP-5 jet fuel from oilers to aircraft carriers need careful examination to avoid unnecessary fuel waste. For example, attack aircraft carriers generally run the first stream of products received from an oiler over the side until assured, by testing of samples from the stream, that the fuel is satisfactory for aircraft use. Diversion of the first stream into a settling tank could achieve the same end without loss of fuel. This fuel could be stripped later for reuse if found not clear.

Aircraft operations on carriers are inherently dangerous. Fueling and defueling procedures have properly placed heavy emphasis on safety aspects of carrier aviation, and have generally involved full internal tank fueling of aircraft as normal procedure as well as use of external tanks when necessary for mission endurance. Consequently, landing on flight decks at design landing weights has often required dumping jet fuel by aircraft prior to landing. Estimates of quantities of fuel lost in this manner indicate them to be relatively low (about 1 percent)—a small price to pay when considered in the light of the safety margins they provide in the event landings are delayed or diverted to alternate decks or fields. Nevertheless, in the current climate of severe JP-5 shortages, aircraft fueling practices need to be reexamined with a view to minimizing dumping losses by better matching of fuel loads to mission requirements.

6.5 CONCLUSIONS

- The DoD conservation program is consistent with the national program and is, in fact, leading in many areas of energy conservation.

- All Services have long-standing utilities conservation programs that are being revived after a period of neglect.

- OSD direction in energy conservation has been oriented primarily toward cost savings and toward installations rather than tactical operations.

- Heavy emphasis on first cost in military construction has precluded consideration of energy conservation and life-cycle costing benefits.

- The conservation seminars drew a favorable response; this technique is a good way to stimulate interest in energy conservation.

- The key points brought out by the on-site sample surveys were the following:

  - An appreciation of the need for energy conservation has not filtered down to the user level.

  - Goals for energy reduction have not been clearly established at the field level.

  - The most successful energy conservation programs are at installations where the commanding officer has taken an active interest.

  - Implementation of specific conservation measures is hampered by low program funding priority and by personnel constraints.

  - Few positive incentives exist to motivate utility system or tactical equipment operators toward improved efficiency in fuel consumption.

  - There is a lack of experienced personnel to negotiate rates with utilities companies.

  - There is good progress in reducing consumption of motor gasoline through driver training, rationing, reduction in number of vehicles, increased frequency of tune-ups, consolidation of trips and other motor pool conservation methods at some activities.

- At the single GOCO facility surveyed, there is good company management-level emphasis on energy conservation.

- The fixed cost of providing utilities to an installation is only slightly affected by reductions in force because most utilities systems are not designed to be cut off by sections or to operate efficiently at part load.

- Currently allocated resources are not adequate to implement an effective conservation program.

6.6 RECOMMENDATIONS

6.1 The Assistant Secretary of Defense (Installations and Logistics) should:

- Establish an office to manage its energy conservation program. This effort should include, among other specific actions, sponsoring a DoD-wide information and education program. The logo and slogan (Save Defense Energy) developed by the Defense Energy Task Group should be adopted and distributed widely in the Department of Defense (see Figure 5).

- Establish with the Services a utilities energy conservation program package similar to the existing air and water pollution abatement program packages.

- Revise the military construction program funding to emphasize energy conservation and life-cycle costing considerations.

- Require the preparation of energy impact statements for major new construction(i.e., greater than $300,000).

- Seek to revise current statutory limitations on dollars per square foot of personnel living space to include an appropriate amount for adding energy conservation features.

- Investigate the establishment of a revolving fund of construction capital to be used for short-term, high-return energy conservation projects.

- Develop and incorporate energy conservation direction in all GOCO contracts.

6.2 The Joint Chiefs of Staff should emphasize the need for energy conservation in tactical operations and should develop a methodology to quantify the impact of fuel shortages on readiness.

6.3 The individual Services should:

- Reemphasize existing conservation programs and institute coordinated programs to include operations as well as installation support with single points of responsibility for energy use management.

- Include in their schools and training programs, at all levels, orientation on the energy problem and the need for energy conservation.

- Institute energy conservation seminars and follow-on field surveys to maintain field level interest as well as receive feedback on accomplishments and problem areas.

- Include specific energy conservation items for Inspector General and staff visits to all installations.

- Establish an incentive awards program for utility and tactical equipment operators as well as managers.

- Reestablish conservation programs such as the Fuel Economy Competition for petroleum fueled ships in the Navy.

- Provide for more journeyman mechanics to improve operation of utility systems and facility maintenance.

- Establish a utility conservation engineer position at major installations to monitor the conservation program and develop conservation practices.

- Increase grade structures in the facilities engineering career field to provide incentives for professional engineers at the installation level.

- Provide the services of expert utility rate engineers at the contract review level.

- Develop contingency plans for dealing with energy shortages at individual installations.

- Institute a vigorous campaign to eliminate or improve the efficiency of temporary buildings, which are characteristically inefficient in their consumption of energy.

CHAPTER 7

ENERGY RESEARCH AND DEVELOPMENT GOALS AND PRIORITIES

7.1 GOALS OF A DEFENSE ENERGY R&D PROGRAM

Two distinct goals must be established as the principal objectives of the DoD energy R&D program:

- To participate with other Government agencies and industry and offer incentives to develop new methods for providing DoD with the energy resources it needs, both now and in the future

- To improve the efficiency with which energy is used in DoD applications, and hence to reduce the amount of energy consumed without impairing operational effectiveness.

These two goals are focused directly on the two essential elements of the energy problem: the supply of energy and the demand for it. These goals are consistent with the objectives of "Project Independence" announced by the President in his energy address on 7 November 1973.

Implicit in this statement of goals is an understanding that all R&D efforts have inherent in them a time element. In the near term, developmental efforts must be directed toward:

- Upgrading the quality and reliability of current energy sources and supply systems

- Establishing the criteria to measure the technical feasibility, cost effectiveness, and mission effectiveness of improvements to currently available energy consuming systems.

In the longer term, advanced development and exploratory research must be directed toward:

- Creation of totally new energy sources

- Innovations in systems designed to accomplish essential missions at a significant reduction in energy consumption.

Both near-term and long-term R&D programs aimed at the two basic goals must be supported in proper balance to ensure that immediate needs are not met at the expense of the future.

Energy R&D is defined as any R&D program that can be demonstrably shown to bring DoD closer to one or both of the two basic goals, either in the long or the short term.

7.2 PRIORITIES FOR THE SELECTION OF ENERGY R&D PROGRAMS TO BE SUPPORTED BY DOD

There are many R&D programs aimed toward meeting the two established primary goals. DoD clearly cannot fund all of them, nor should it. It is therefore essential to establish a set of priorities for the allocation of resources from a fixed R&D budget against program areas. This report will not endeavor to address the broader question of how much should DoD spend on energy R&D or the priority of energy R&D relative to other R&D requirements of DoD.

Two fundamental factors should determine priority and level of effort devoted to specific areas of energy R&D activity:

- The amount and type of energy consumed in the various DoD activities

- The relative efficiency with which energy is consumed in those activities to accomplish missions.

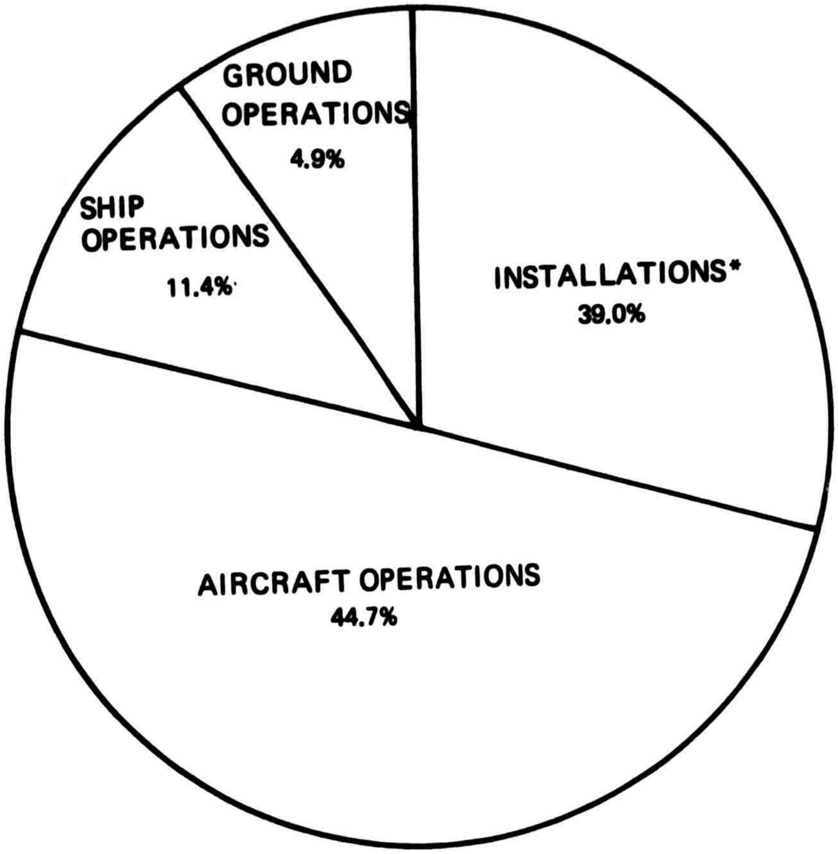
This approach again focuses on resources and consumptive uses—supply and demand.

Figure 7-1 shows a breakdown of DoD energy uses. Nuclear aspects are treated in Chapter 9. This figure shows that aircraft operations and installations account for more than 80 percent of all energy consumed. The highest priority in energy R&D aimed at improving consumption efficiency must clearly be given to programs that relate to aircraft power systems, which account for almost half of the energy consumed. Expenditures devoted to R&D programs aimed at other energy-consuming systems must be apportioned to achieve maximum impact on energy-use reductions. There is a caveat that must be inserted in this argument. If the efficiency of a particular energy-consuming device is already high, it may not be worthwhile to expend large amounts of R&D money on efforts to achieve incremental improvements.

Figure 7-2 shows the relative DoD requirements for each type of energy source. Since petroleum is by far the most important fuel in terms of current requirements, it is evident that the greatest priority in energy R&D aimed at supply of energy should be given to those programs focused either on increasing supplies of petroleum or on replacing petroleum with other equally acceptable fuels. Because the energy requirements picture will change each year as new technology is introduced and missions change, it is important to base R&D priorities on a projection of energy resource requirements in the future.

A critical question to ask in establishing priorities for DoD funding of energy R&D is: Should DoD support the program or should some other Federal agency or private industry support it? There are many R&D projects that pass all the filters set but are still not logical candidates for DoD funding. Hence, it is important to establish for each program area who should take the lead role. Three categories of responsibility can be established:

- DoD has a unique or essential supporting role and should fund the research
- Other Federal agencies are more logical choices to support the research
- Private industry has the incentive to support the research independently of Federal funding.



*INCLUDES:
- PURCHASED ELECTRICAL ENERGY
- NATURAL GAS AND PROPANE
- FUEL OIL
- COAL
- PURCHASED STEAM AND HOT WATER

FIGURE 7-1. PROJECTED FY74 WORLDWIDE DOD PRIMARY ENERGY USE (EXCLUDING NUCLEAR)

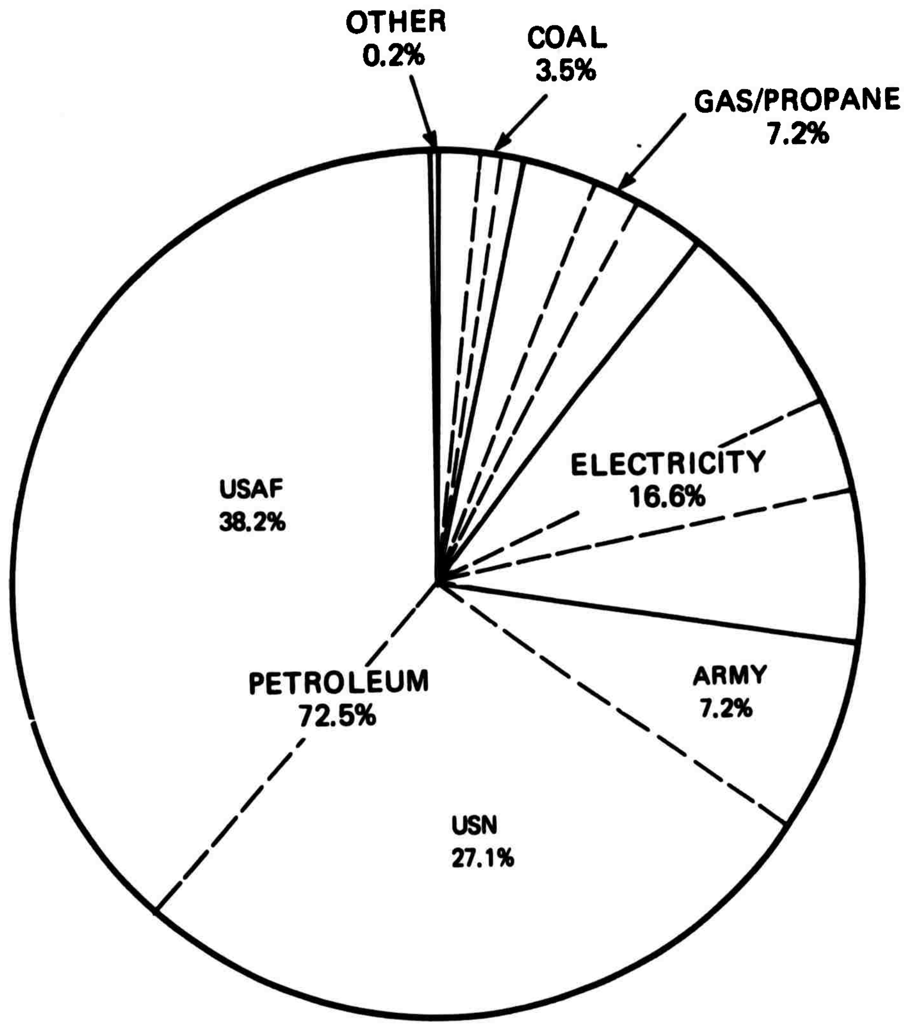


FIGURE 7-2. PROJECTED FY74 DOD WORLDWIDE ENERGY CONSUMPTION (EXCLUDING NUCLEAR)
(Service shares are in the same sequence as shown for petroleum)

There are, of course, grey areas in determining R&D priorities according to the most suitable lead group. For example, nuclear reactor research is primarily an AEC concern, but DoD has its own special applications of nuclear systems, and it is reasonable to expect it to conduct some R&D in this area. Similarly, R&D on synthetic petroleum is most logically the responsibility of Federal agencies other than DoD. But, because DoD has such a strong vested interest in the results, it may reasonably choose to contribute some support to the effort or provide incentives to industry to pursue early commercialization of processes now in the pilot plant stage. For example, DoD may guarantee, subject to the availability of funds, to purchase the product stream from a syncrude plant for its own use at production cost in order to stimulate immediate construction of a commercial scale plant. In any event, DoD should follow very closely the progress of R&D in this important area.

The main point to emphasize here is that the priority decisions on R&D program support are not always unequivocal. But the structure presented provides a reasonable framework for allocation of DoD resources against areas of R&D endeavor.

7.3 CRITERIA FOR SELECTION OF SPECIFIC R&D PROPOSALS IN PRIORITY AREAS

Once it has been determined that a group of specific R&D proposals are aimed at the appropriate objectives and fall in a high priority area of DoD concern, then it is necessary to select from among those proposals the ones to be funded. Such a selection process should be based on the following criteria:

- Professional estimates of the probability of technical success
- Estimated time to completion of the project
- The net benefits in energy savings and dollars of the project if it is successful
- The relative importance of the specific need to be met by the project (i.e., selective screening within priority areas).

Clearly, these criteria must be applied judiciously. It is tempting to develop a highly systematic and largely automated procedure for screening proposals, but such a system may tend to discriminate against high-risk efforts with potentially great payoff. There has been no demonstration that the intuitive judgment of experts who have a broad perspective is not the best approach for applying these criteria. However, the increased use of cost-benefit analysis techniques in evaluating R&D proposals will certainly help to increase the probability of selecting high-payoff programs for support.

7.4 STRATEGY FOR DOD ENERGY R&D

Based on the goals, priorities, and criteria established in the preceding discussion, four major R&D program areas can be recommended for DoD concern:

- Improvements in the propulsion of mobile systems
- Development of alternative fuel systems
- Reduction in energy consumption at bases and facilities
- Development of advanced energy sources.

Whenever it is feasible to do so, the DoD energy R&D effort should be fully coordinated with related R&D programs sponsored by other Federal agencies and private industry. In addition, the recommended R&D activities must be consistent with the DoD Environmental Protection Program and must not in any way lead to a compromise of operational readiness. It should also be noted that these program areas do not include other significant areas of Defense R&D which will ultimately reduce fuel consumption by making available such alternatives as remotely piloted vehicles (RPVs) and "smart" bombs. RPVs, for example, would have a lower gross weight than manned vehicles for a given payload, and "smart" bombs would provide a given probability of target destruction with fewer sorties.

Having established a set of major program areas in which DoD energy R&D effort should be concentrated, the next step is to identify specific areas of emphasis and to determine:

- The time frame from initiation to proof of concept for each R&D activity

- The role DoD should play in support of each specific activity.

Table 7-1 presents, in matrix format, an overview of the recommended DoD participation in key energy-related programs in the four principal areas of concern. The terms used in this matrix have the following definitions:

- Lead—DoD is the major source of R&D funding.

- Participate—DoD provides a share of the necessary funding in conjunction with other Federal agencies and/or private industry.

- Monitor—DoD does not fund hardware development directly but observes progress closely, makes DoD needs known, and provides resources, analyses, and indirect support (e.g., building insulation test facilities) for specific military adaptations.

- Incentivize—DoD does not fund hardware development directly but may provide appropriate incentives (e.g., guarantee a market for syncrude subject to the availability of funds, resources and analyses for specific military adaptations.

Although production of synthetic petroleum is extremely important to DoD from the national energy standpoint, no significant expenditure of DoD money for R&D in this area is recommended. In wartime, the DoD will have first priority on available supplies of domestic petroleum, which are more than adequate to meet military needs. As discussed in Chapter 2, the DoD requirement for petroleum products in a major war would be less than 10 percent of the estimated total U.S. consumption in 1973. During peacetime, however, DoD must compete in the marketplace for its supply of petroleum, and is as vulnerable as other consumers to spot shortages. Although the goal of becoming self-sufficient in energy production has a high national priority, it is more properly the role of other Federal agencies and industry to fund directly for the necessary R&D.

TABLE 7-1

RECOMMENDED DOD ROLE IN ENERGY R&D*

R&D PROGRAMS	Time Frame for Application		
	Near-Term (0-7 years)	Midterm (8-15 years)	Long-Term (>15 years)
I. Improvements in Propulsion of Mobile Systems			
• Aircraft Engines	Lead	Lead	Participate
• Aircraft Engine Materials	Lead	Lead	Participate
• Ship Conventional Machinery	Participate	Participate	Participate
• Ship Nuclear Machinery (less reactors)	Lead	Lead	Lead
• Ship Superconducting Machinery	Lead	Participate	Monitor
• Land Vehicles—Diesel & Other Piston Engines	Participate	Participate	Monitor
• Land Vehicles—Turbine Engines	Participate	Participate	Monitor
• Land Vehicles—Transmissions	Participate	Participate	Monitor
II. Development of Alternative Fuel Systems			
• Synthetic Petroleum	Incentivize	Incentivize	Incentivize
• Direct Use of Coal	Monitor	Incentivize	Incentivize
• Hydrogen	Monitor	Monitor	Monitor
• Electrochemical	Monitor	Monitor	Monitor
III. Reduction in Energy Consumption at Bases and Facilities			
• Improved Insulating Materials	Incentivize	Monitor	Monitor
• Heat Recovery Techniques	Monitor	Monitor	Monitor
• Advanced Methods of Energy Storage and Distribution	Participate	Monitor	Monitor
• Total Energy Systems	Participate	Monitor	Monitor
• Advanced Power Plants	Monitor	Monitor	Monitor
IV. Development of Advanced Energy Sources			
• Solar	Monitor	Monitor	Monitor
• Geothermal	Monitor	Monitor	Monitor
• Nuclear Fusion	Monitor	Monitor	Monitor

* The primary justification for a specific program may be related to a military mission in which context the DoD role may differ with that shown in this table.

7.5 STATUS AND ANALYSIS OF DOD ENERGY-RELATED R&D PROGRAMS AND PLANS

This section is classified CONFIDENTIAL and is contained in Chapter 9 as Section 9.4.

7.6 CONCLUSIONS

- The DETG review of DoD energy-related R&D has been preliminary and is not necessarily conclusive.
- The matrix of programs and recommended DoD participation therein (Table 7-1) is the first attempt to define DoD's role in energy R&D.
- Currently planned and programmed R&D projects do not seem to be well aligned with the strategy outlined by the matrix. Detailed appraisals are contained in Section 9.4 of this report.

7.7 RECOMMENDATIONS

7-1. The Director of Defense Research and Engineering and the Services should further refine the matrix presented in this chapter and use it as a basis for evaluating energy-related R&D programs.

7-2. In conjunction with the Assistant Secretary of Defense (Installations and Logistics), the Director of Defense Research and Engineering should perform a detailed review of planned and programmed energy-related R&D projects in order to restructure the overall program to be consistent with the refined matrix.

7-3. The Director of Defense Research and Engineering should assign lead responsibility for each R&D project category to one Service in order to avoid duplication and assure proper emphasis and coverage.

CHAPTER 8

ORGANIZATION AND MANAGEMENT

8.1 INTRODUCTION

This chapter addresses the subject of energy management within the Department of Defense. There are five sections to the chapter: Section 8.2 examines the present organization for energy management and pinpoints its deficiencies. Guidelines and functions for a new organization are delineated, alternative organizational structures are examined, and a recommended organization is presented, together with the rationale for its selection. Section 8.3 reviews the existing priority system and allocation organization, outlines their deficiencies, and makes recommendations for improved management of potential energy hardships and crises. Section 8.4 is devoted to developing a problem-solving DoD Energy Information System. Sections 8.5 and 8.6 contain conclusions and recommendations respectively.

8.2 ORGANIZATION FOR ENERGY MANAGEMENT

8.2.1 Present Organization

Responsibilities within DoD which relate to energy are presently fragmented and diffused. Figure 8-1 illustrates this point. This fragmentation is a direct consequence of the multifaceted nature of energy. Almost every element in DoD performs a job that relates in some way to energy, but most people are concerned with energy as only a part of a larger function, and each views energy from a different perspective. For example, the Directorate of Logistics (J-4), in the organization of the Joint Chiefs of Staff, is concerned with energy for operational readiness; ASD (Compt), for budgeting; and ASD(I&L), for supply and conservation.

Most of the existing organizations within DoD which manage energy were created to perform functions only incidentally concerned with energy. They were created before the availability of energy had become problematic, and until the recent energy shortage arose,

this fragmentation of energy control presented no real management problem. However, a more centralized control of energy matters is clearly indicated in today's environment. The functions of the various components of DoD as they relate to energy are outlined in Figure 8-1.

8.2.2 Deficiencies in Present Organization for Energy Management

The energy problem, as it is developing at both the national and the Department of Defense levels, presents certain difficulties for the existing organizations within DoD. The more significant deficiencies in the organization of the Office of the Secretary of Defense, as they relate to the overall energy problem, are as follows:

- There is no clearly identified focal point for energy matters. Presently, the person who most closely fulfills this need is the Assistant for Petroleum Matters on the staff of the ASD(I&L). However, by title and charter, he is concerned only with petroleum matters and not the overall energy picture. A focal point is needed to present a single DoD response and position on energy matters.

- There is no single office designated to coordinate energy matters. As certain aspects of the energy problem become increasingly significant (e.g., economic, R&D, environmental, allocations, and international security affairs), an authoritative office must be established to coordinate these numerous and varied aspects of the energy picture. At present, a lack of coordination leads to problems of planning and duplication of efforts.

- The DoD organization is not presently constituted to handle effectively the anticipated daily operational energy problems of allocations and priorities. Presently, the Joint Materiel Priorities and Allocations Board (JMPAB) within the Joint Staff of the Joint Chiefs of Staff comes closest to fulfilling this need. However, it is anticipated that future energy demands and problems in this area will require more attention than the JMPAB is presently capable of providing. Frequent, perhaps continuous, high-level attention may be required in the

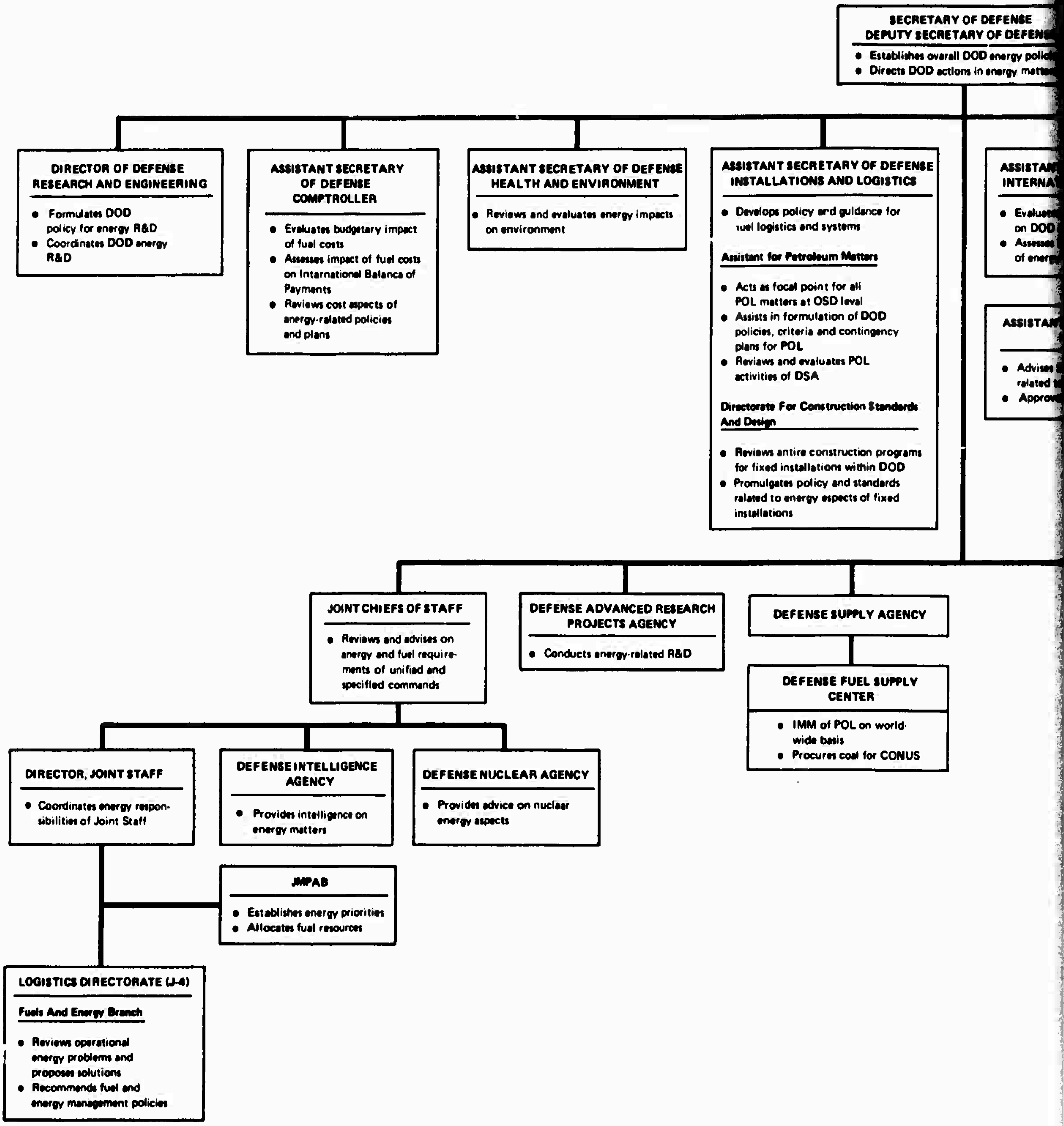
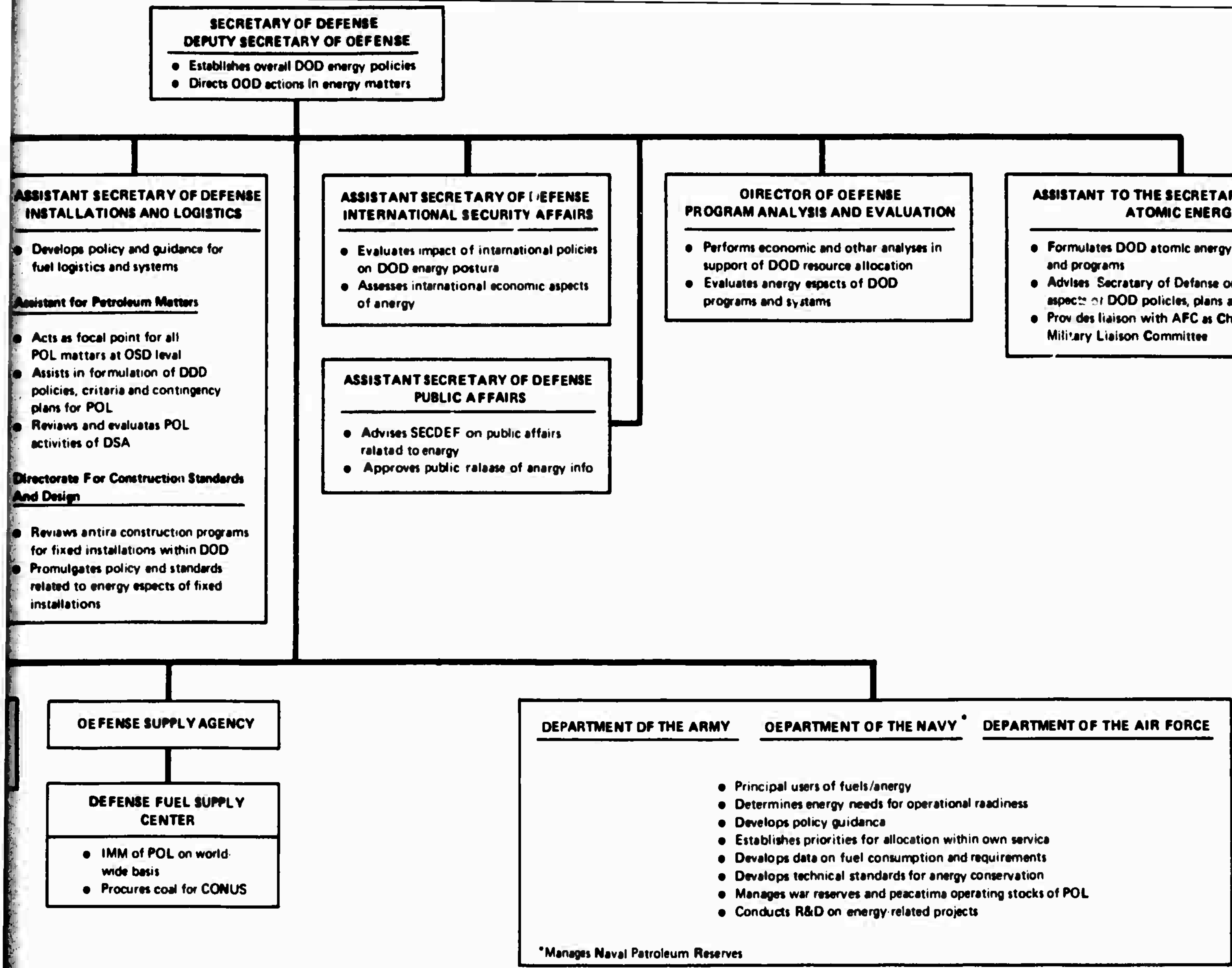


FIGURE 8-1. EXISTING DOD FUNCTIONAL



TING DOD FUNCTIONAL ORGANIZATION FOR ENERGY

near term for energy problems that impact on operational readiness. This would tend to dilute JMPAB's capability for making important decisions on other materiel problems.

- There is a need for greater awareness outside DoD with respect to what is being done within DoD in energy matters. The requirements here go beyond a simple public relations matter. As energy shortages on the national level become more important, there will be increasing pressure on DoD to reduce its consumption of energy. DoD must be able to convey clearly to other Government agencies and to the public what is being done to conserve energy, its energy-related R&D need, and the effects on operational readiness of any additional energy reductions.

- The present staffing within OSD which is devoted to energy matters may be inadequate to cope with future problems. Future energy problems are expected to be more numerous, complex, and of greater national importance than in the past. This may require more personnel dedicated to the emerging energy needs. For example, fuels present fundamental and difficult logistic problems. Yet, at present, only two professionals are authorized in the Office of Assistant for Petroleum Matters. Furthermore, this organization is supposed to be concerned with only the petroleum portion of the broader energy problem.

8.2.3 Guidelines and Functions for a New DoD Energy Management Organization

In view of the deficiencies in the existing DoD organization in relation to the emerging energy problems, it is apparent that some changes are necessary to improve the management of energy matters. In developing various organizational alternatives to ameliorate or eliminate these deficiencies, certain basic considerations are fundamental:

- Operational readiness is of paramount importance

- The new management structure for energy must be coordinated from the OSD level because the energy problem requires interfacing with many other Government organizations at the national level. OSD coordination is also required because the energy problem impacts on all DoD activities.

- Changes that involve legislation are to be avoided.

- The new organization for energy must be compatible with current and anticipated national programs and organizations.

- The new organization for energy must be responsive to the needs of the military services.

- Duplication of functions is to be avoided.

- Any increase in manpower is to be minimized.

- A high degree of flexibility must be present to be responsive to changing national organizations and policies.

- The new organization must be compatible with the posture that DoD maintains on energy.

The new organization for energy must perform the following functions:

- Formulate and recommend policy with respect to the allocation, supply, and use of energy resources within the DoD

- Monitor DoD R&D programs to ensure appropriate emphasis and direction in support of energy policy

- Manage the DoD energy conservation program

- Monitor national security programs for treatment of energy-related matters

- Develop an integrated energy information system within DoD

- Review and comment on energy-related legislation of interest to DoD

- Maintain liaison and coordinate energy resources matters with external Federal Agencies (e.g., Office of Energy Policy, DOI, DOT, HUD, AEC).

8.2.4 Alternative Management Organizations

A large number of possible organizations (see Table 8-1) were considered and judged against these guidelines and functions. This list was narrowed to three. The principal distinguishing characteristic of these three alternatives is the location of the "focal point" for energy matters within DoD. The recommended organization focuses energy responsibility on a Director for Energy at a level immediately under ASD(I&L). The two other alternatives focus responsibility on an Assistant to the Secretary of Defense (ATSD) (Energy) and a Special Assistant for Energy to the Secretary of Defense.

These latter two alternatives were considered less desirable than the recommended organization because of:

- Excessive additional manpower requirements

- Increase in number of people reporting directly to the Secretary of Defense and Deputy Secretary of Defense

- Large portion of energy responsibility is inseparable from ASD(I&L) mission.

8.2.5 Description of Recommended Organization

A Director for Energy would be established in OASD(I&L) who would report directly to ASD(I&L) and be a program manager for energy. Thus, the DoD energy focal point would be clearly in OASD(I&L). The Director for Energy would have Assistants for Energy Requirements (currently the Assistant for Petroleum Matters to ASD(I&L)), for Energy Resources, and for Energy Conservation.

Responsibility for approving major policy guidance would be assigned to a new body called the Defense Energy Policy Council (DEPC). This Council would meet on call and would be chaired by ASD(I&L). It would be

TABLE 8-1

ALTERNATIVE MANAGEMENT ORGANIZATIONS

Organization	Implementation						Function						
	Does Not Require Change to Legislation	Compatible With Existing Programs and Organizations	Does Not Duplicate Functions	Minimizes Manpower Increases	Provides Flexibility	Compatible With DoD Energy Posture	Formulate and Recommend Policy	Monitor OSD and Service R&D Programs	Manage Conservation Programs	Monitor OSD and JCS Energy Programs	Establish and Maintain DEIS	Review and Comment on Legislation	Liaison With Government Agencies
ATSD	X						X	X	X	X	X	X	X
ASD							X		X	X		X	X
Dir. of Energy, OASD(I&L)*	X	X	X	X	X	X	X	X	X	X	X	X	X
Spec. Ass't. to SECDEF	X						X	X		X			X
Energy Coordinator with OSD Focal Points	X			X	X	X	X			X		X	X
DASD	X	X	X			X	X	X	X	X	X	X	X

composed of ASD(ISA), ASD(H&E), DDR&E, DDPA&E, and ATSD(AE), or their designees. Also, J-4(OJCS) and DSA would be represented. The Director for Energy, OASD(I&L), would provide staff support.

The function of the DEPC would be to discuss controversial energy policy issues and to develop broad energy policy guidelines. A unified energy policy would emerge from the DEPC which should ensure that the various elements of OSD are not working at cross purposes. The Director for Energy would be responsible for recommending and implementing policies and for coordinating the preparation of background papers for use by the members of DEPC.

In addition, an effective mechanism is needed to allocate energy resources within DoD. Hardship cases exist throughout the country in different degrees, and DoD will be involved with the civilian sector in allocation of energy resources. Hardship cases would best be resolved at the OSD level, particularly since they would often require interaction with the military services, JCS, and other Government agencies.

To resolve conflicts of this sort, the DEPC would have a subsidiary organization called the Energy Hardship Panel (EHP), which would be chaired by the Director for Energy. It would be composed of representatives from the three military services, JCS, and DSA/DFSC, with staff support provided by the Director for Energy.

When a question of allocations among unified and specified communities arises, the EHP would refer the issue to JCS for advice as to resolution.

It must be emphasized that the function of the Directorate for Energy would not be to absorb all energy-related functions now being performed in OSD, but to coordinate the efforts in these diverse areas. Figure 8-2 depicts the proposed organizational changes.

The advantages of the recommended organization over all the other alternatives considered are:

- It provides the least disruption to the existing OSD organization.
- It requires the least additional manpower.
- It retains responsibility for energy supply, a key function of logistics management, within the OASD(I&L) organization.

- Reasonably high visibility is given to the focal point for DoD energy problems by establishing a Director for Energy.

- The organizational concept should result in integrated energy policies reflecting the functional interests of all OSD elements.

- The directorate can be established immediately using personnel presently assigned to the DETG and OASD(I&L).

The disadvantage of the recommended organization is that the Director for Energy may not be high enough in the OSD organization to coordinate effectively. The existence of DEPC should overcome this disadvantage because the senior representatives in each OSD element will participate in the establishment of energy policies.

The military services are currently investigating needed organizational changes in order to manage effectively energy matters in today's environment. They each should have energy management organizations compatible with and responsive to the OSD organization. They recognize the desirability of a single point of contact to facilitate coordination on energy matters, and the DETG endorses this trend. A similar effort also has been initiated within DSA.

8.3 INVESTIGATION OF EXISTING AND ALTERNATIVE PRIORITY SYSTEMS AND ALLOCATION ORGANIZATIONS FOR DOD ENERGY

8.3.1 Purpose of the Investigation

The purpose of this investigation was to develop recommendations for:

- A DoD energy priority system

- An organization for allocation of energy within DoD.

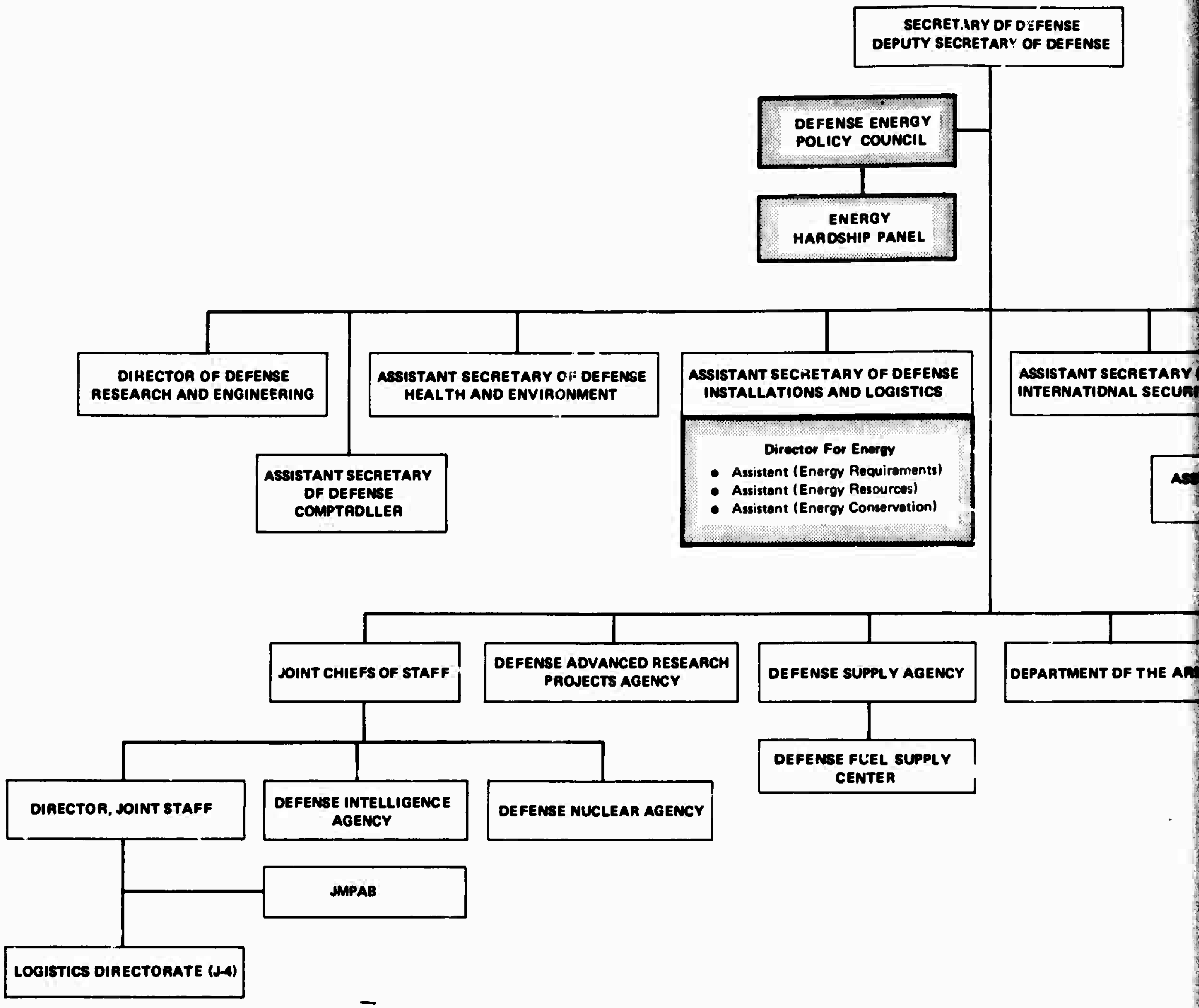
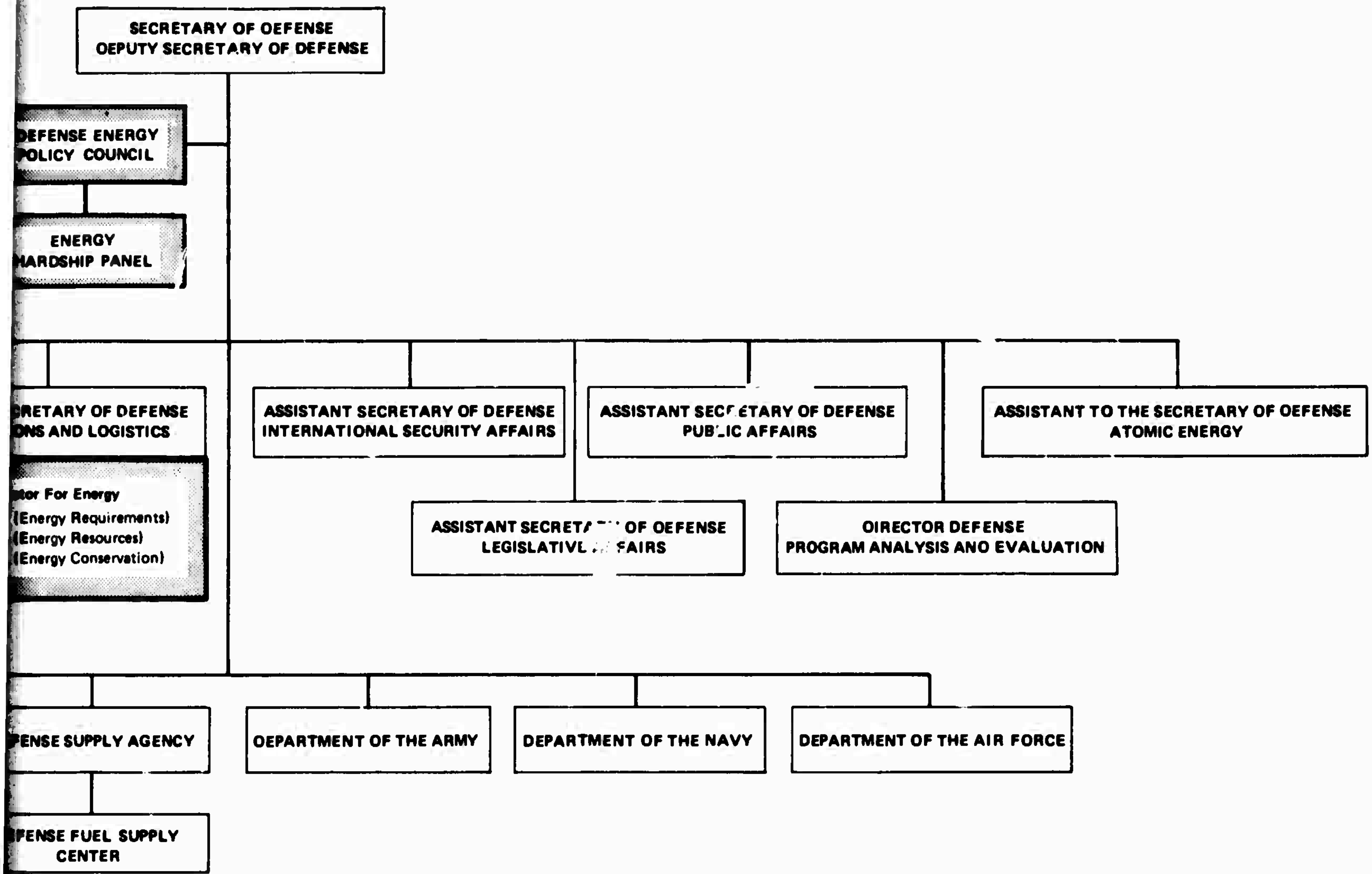


FIGURE 8-2. RECOMMENDED ORGANIZATION FOR E



MENDED ORGANIZATION FOR ENERGY MANAGEMENT

8.3.2 Review of Current Priority Systems and Allocation Organizations

At the national level, mandatory energy allocation programs are instituted through the Office of Energy Policy. In addition, DOI can invoke the Defense Production Act, which ensures that DoD essential energy requirements are met in the interest of national security.

Within DoD, the primary materiel allocation system is the Uniform Materiel Movement and Issue Priority System (UMMIPS). This system functions as follows: An integer priority designator, ranging from 1 to 15, is assigned. The priority is arrived at by feeding the following two parameters into a matrix:

- A Force Activity Designator (FAD) ranging from I to V which relates the importance of the requisitioning activity to national survival

- The Urgency of Need Designator (UND) ranging from A to C which relates the urgency in time that the materiel is needed.

The derivation of priority designators is illustrated in Table 8-2.

TABLE 8-2
DERIVATION OF PRIORITY DESIGNATORS

FAD \ UND	A	B	C
I	01	04	11
II	02	05	12
III	03	06	13
IV	07	09	14
V	08	10	15

The existing organizations within DoD through which allocation decisions relating to fuel could be made are illustrated in Figure 8-3. A brief description of the responsibilities of the various organizations is as follows:

- The Assistant Secretary of Defense (Installations and Logistics) has the following responsibilities relating to DoD petroleum logistics:
  - DoD claimant on the Department of the Interior for POL products
  - Implementation of the UMMIPS priority system and allocation of critical material
  - Resolution of competing requirements
  - Establishing policies and providing guidance
  - Continuous review during periods of international tension or limited war.
- The Joint Staff responsibilities include the following:
  - Assignment of priorities for selected forces and activities.
  - Allocation of petroleum products among the military departments during an emergency. (However, authority for use of prepositioned war reserve stocks rests with the military services or commanders of the unified commands.)
- The Joint Materiel Priorities and Allocation Board (JMPAB) is the JCS agency charged with performing duties relating to the establishment of materiel priorities and allocation of resources.
- The Commander, Defense Fuel Supply Center (DFSC), is the Integrated Materiel Manager for bulk petroleum products and is responsible for:
  - Procurement of bulk POL products

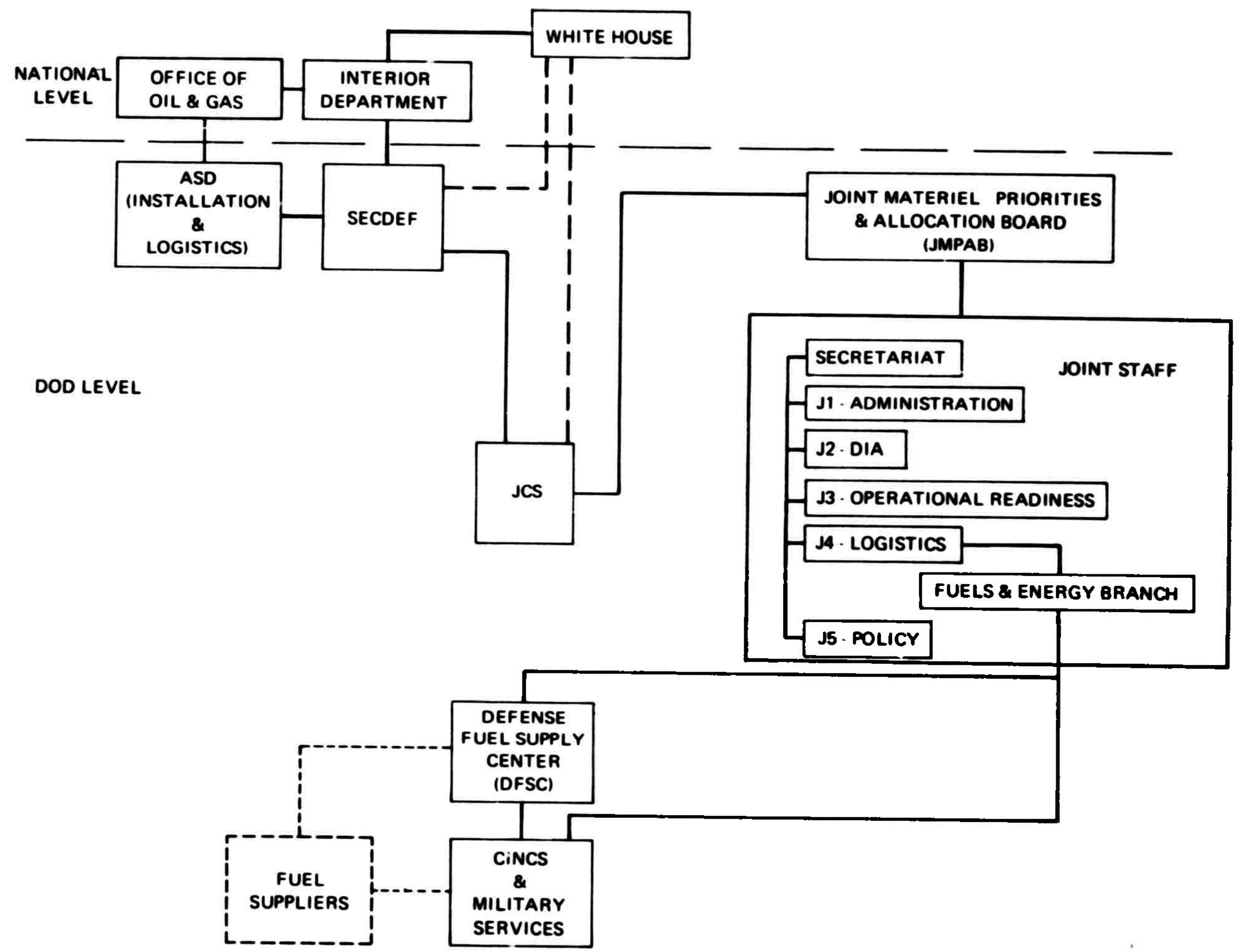


FIGURE 8-3. BASIC ORGANIZATION FOR ALLOCATING FUEL

- Delivery to CONUS and overseas stations.

- The military departments are responsible for:
  - Determination of fuel requirements
  - Management and operation of war reserve petroleum products on base.

- The base and facility commanders have the responsibility for:
  - Final authority for allocation and disposition of operational fuel resources
  - Accurate assignment of priority designators and validation of required delivery dates when assigned to requisition.

8.3.3 Examination of the Adequacy of Existing System and Organization

At present there exists one priority designation system and one organization dedicated to materiel allocation. These were examined to determine whether they should be retained for the function of allocating fuels or whether new structures should be developed.

8.3.3.1 Examination of Existing Priority Designation System

The UMMIPS, described earlier, is the only priority specifier within DoD which is official and well developed. Examination of UMMIPS indicated that it is a logical candidate to carry out fuel allocation. However, several potential weaknesses of this system were identified:

- Activities specify their own Urgency of Need Designations in requisitioning materiel. This will undoubtedly allow unpredictable and irregular escalation of self-assigned priorities in time of emergency. Furthermore, a major part of the administrative effort now called for

in the chartering of documents for UMMIPS is related to supervision by unit commanders to keep the system credible. If actually carried out, this amount of administrative review and supervision would be very burdensome.

- UMMIPS is presently applied to installations, forces, and other broad activities. It thus cannot recognize differences in priority between different types of fuel usage within a command or between different tenant facilities on an installation.

- There is no provision for reducing the allocation of fuel to activities of higher priorities to prevent complete fuel cutoff to activities of lower priorities.

These deficiencies are correctable and consideration should be given to using UMMIPS for fuel priority designation, with the modifications described in Section 8.3.4.

8.3.3.2 Examination of Existing Allocation Organization.

The JMPAB, described earlier, is the only organization within DoD which is dedicated to the allocation of materiel within DoD. Several weaknesses of this organization related to the allocation of petroleum were identified.

- The Board is an ad hoc committee. Thus, the attention of the Board members would be divided between their duties on the board and their duties in their parent organizations.

- The Board is concerned with materiel of all types. Consequently, adequate concentration may not be available to address the particular urgency of petroleum allocation.

- The Board can reach decisions only with the unanimous consent of representatives from all Services. In the event of a failure to reach agreement, questions must be appealed to the Joint Chiefs of Staff, who in times of crisis may be too preoccupied with other matters to deal with the dispute quickly enough or thoroughly enough.

Because of the severity and the intrinsic nature of these shortcomings, it was felt that JMPAB might not adequately fulfill the fuel allocation function under conditions that are expected to occur in the future.

8.3.4 Improvement of the Existing Priority System and Definition of a New Allocation Organization

8.3.4.1 Optimization of UMMIPS for Fuel Priority Designation

UMMIPS could be used as a tool to help establish fuel allocation priorities, provided the following modifications are made:

- The Urgency of Need Designators should not be assigned by the requisitioning facilities themselves, but by centralized authorities, such as CINCs.

- The priority designators for broad activities should be subdivided either by specific activity type (e.g., aircraft vs. barracks) or by specific fuel type (e.g., jet fuel vs. heating oil). This change can be made without affecting the use of UMMIPS for types of materiel other than fuels.

- To prevent the complete depletion of lower priority activities at the expense of higher priority units, weighting factors should be added to UMMIPS so that a unit of Priority 1 always gets the largest fraction of its requirements, and the supplies of lower priority forces are scaled down from there with at least some fuel being provided to all forces needed to continue fighting. The distribution of weighting factors will change with the severity of shortages, ranging from 100 percent across-the-board downward. The weighting factors will be <u>provided</u> by a central authority, such as JCS, and will be <u>applied</u> by all supply activities dispersing fuels. This scheme can be applied to fuels alone, without modifying the existing UMMIPS for other commodities.

8.3.4.2 New Fuel Allocation Organization Within OJCS

If JMPAB proves to be inadequate to support the Energy Hardship Panel, a new fuel allocation organization should be established to meet the following conditions:

- It should be limited specifically to the allocation of fuels.
- It should have well-developed communication lines to sources of fuel data. To come into operation in the shortest time and to prevent duplication of facilities, this means that the organization should fully exploit all existing communication facilities and data bases.
- It should be a permanent organization, with at least a core staff providing undivided attention to the task of allocating fuels.
- It should not require unanimous or majority consent of all the Services for routine decisions.

The identification of a new OJCS allocation organization was facilitated by the use of an existing organization, the Joint Transportation Board (JTB), as a partial model. The use of this model is expected to expedite the formation of the new allocation organization. However, experience with the JTB and with other agencies, such as JMPAB, indicates that several modifications of the existing JTB structure would be advisable. The Joint Transportation Board has a number of salient characteristics:

- It is responsible to the Joint Chiefs of Staff.
- It is independent of other branches of the Joint Staff.
- It has representatives from each of the Services.
- It has the task of forecasting as well as monitoring the balance between supply and demand.
- It fulfills an auxiliary function of serving as a voluntary forum for resolution of disputes brought to it.
- A Secretariat is provided by the Joint Staff.

- The chairman is an officer who is permanently assigned to other JCS responsibilities.

- The degree of effort is variable with need, ranging from continuous session during periods of crisis to monthly meetings when no questions are active.

The first six of these characteristics would be desirable in energy allocation, and the last two would be weaknesses. In time of crisis, the assignment of the chairman of the Board to other duties would reduce his ability to respond to matters before the Board, and the ability to adapt level of effort to the current situation is incompatible with an organization dedicated to a specific task. However, these points are not deemed of overriding importance in view of expected circumstances.

8.3.5 The Defense Production Act

The discussion of this section so far has dealt with means of allocation strictly internal to DoD. The mechanism for ensuring that critical materiel is allocated to DoD at the national level is the Defense Production Act of 1950, as amended. This act:

- Establishes a system of priorities and allocation for materiel and facilities to be supplied to DoD

- Authorizes the requisitioning of materiel and facilities for DoD use

- Provides for various ancillary functions such as credit control and price stabilization.

The Act is in effect an authorization by the Congress for the President to divert and transfer from the civil economy the materiel and facilities that DoD needs to ensure defense. The President has delegated authority to implement the Act to:

- The Department of the Interior, for petroleum and gas production

- The Department of Commerce, for all other materiel.

Allocations under the Act have been carried out on a number of occasions for these materiel under the purview of the Department of Commerce. However, the Act had never before been invoked for the allocation of petroleum.

On 27 September 1973, the ASD(I&L) requested that DOI invoke the Defense Production Act to ensure an adequate supply of petroleum to DoD; the Act was invoked on 1 November 1973. It is contemplated as discussed in Section 8.2.5, that the Energy Hardship Panel would be the focal point in OSD for dealing with DOI on these matters.

8.4 DOD ENERGY INFORMATION SYSTEM

8.4.1 The Problem and Current Status of Energy Information in DoD

To manage its energy properly, DoD needs ready access to up-to-date, reliable, and objective energy information. All forms of energy are of interest (e.g., petroleum, natural gas, electrical, propane, and nuclear). A spectrum of problem types—fuel shortages to R&D—must be addressed and decisions made in situations ranging from routine daily operations to national emergencies. DoD must be able to anticipate many of these energy-related problems with assessments based on valid data so that corrective action can be taken at the earliest possible time.

8.4.1.1 The Problem of Energy Information Management in DoD

There is no consolidated energy information data base within DoD at the present. For each energy type, DoD requires information such as:

- Consumption rates of Service elements
- Present and projected quantities available
- Storage locations and capacities
- Distribution systems, rates, and capacities
- Budgets and costs.

The amount of information needed is enormous. For some energy types partial information is available in several dispersed data bases within DoD. For other energy types, none is available, nor are mechanisms established to collect the data. At present, it is extremely difficult to assemble rapidly all data known to be available in the data bases pertaining to a given energy problem because of different recording, accessing, and processing procedures.

For example, the energy information used at the OSD level is processed manually and is aggregated and lacking in specific details. As a result, only a broad overview of the energy situation at lower levels is presently available at the OSD level and this is almost entirely limited to petroleum. Decisionmakers often find that specific energy questions cannot be answered by the use of OSD-level energy information alone. This situation requires OSD to seek, often by direct contact, more detail from the Services when a very specific energy question must be answered. However, in seeking to obtain more detailed energy information, such as that required by other governmental agencies, OSD decisionmakers are frustrated by the nonuniformity of information in the responses of the Services and other DoD components. Thus, energy data from DoD agencies is difficult to collect, correlate, and assimilate. Clearly, a consolidated energy information system is needed with standardized input and handling procedures.

8.4.1.2 Available Data Bases Having Energy Data Elements

Figure 8-4 is a simplified schematic showing the current general structure of DoD information components, together with descriptions of the information contained in each component. The schematic shows a hierarchy of successive aggregation of information intended to serve the needs of progressively higher levels of management.

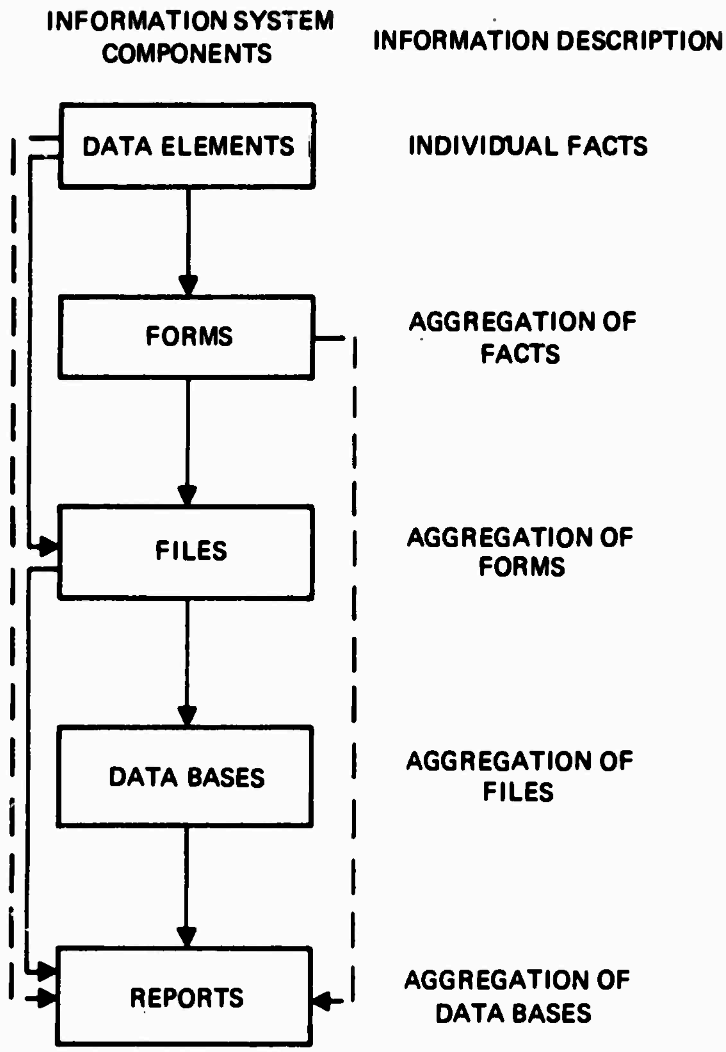


FIGURE 8-4. SCHEMATIC OF DOD INFORMATION ORGANIZATION

An analysis of the principal available data bases in DoD related to energy indicates that only in the fuels area, managed presently by the Defense Fuel Supply Center (DFSC), is there a substantial amount of organized data covering all of DoD. Therefore, this discussion focuses on DFSC activities, although it is recognized that the individual Services have data bases and procedures for handling fuels and other energy data much of which is forwarded to DFSC in aggregated form.

8.4.1.3 Characteristics of DFSC Data Management

Existing DFSC data files contain most of the essential information items, but they are scattered among numerous files. Acquiring a complete account of fuel quantities, inventories, dispersements and stocks may involve several different data bases or files. Therefore, those who require specific information on an item may receive information only partially responsive to their needs. Generally, data bases can be grouped into two main categories: procurement and production, and supply and distribution, related by certain common data elements.

DFSC energy data reports of several types dealing with quantities of petroleum products are issued at various intervals, mostly monthly. Depending on the date of submission of data elements or forms to the DFSC, some reports are out of date by at least 25 days. Although these reports are perhaps adequate for normal supply and demand conditions, more current data are required during periods of protracted shortages and military operations.

Documentation on DFSC transactions is by a family of Department of Defense forms (DD Forms). Figure 8-5 indicates the sequence of transactions, involving petroleum products and coal, between principal organizations, and the flow of implementing DD forms. The data, though available in the Services, is not always reported* on the same basis, and is difficult to acquire in a consistent manner.

DFSC shares the computer facilities at the DSA Support Center (DSASC). The DSASC computer system operates in a basic batch-processing mode. DSASC priorities and lack of remote access capability limit DFSC's flexibility. Integrated automated processing has been initiated by DFSC, but it has not been fully implemented because of the need to respond to urgent information demands that have required deferral of planned improvements.

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*Each of the three military services also gather data related to their fuel supply and demand requirements. At present, the Air Force has an automated base reporting system used to process these data. The Army and the Navy have a system that is primarily manual to process fuel data. Each Service provides input data to DFSC in aggregated form.

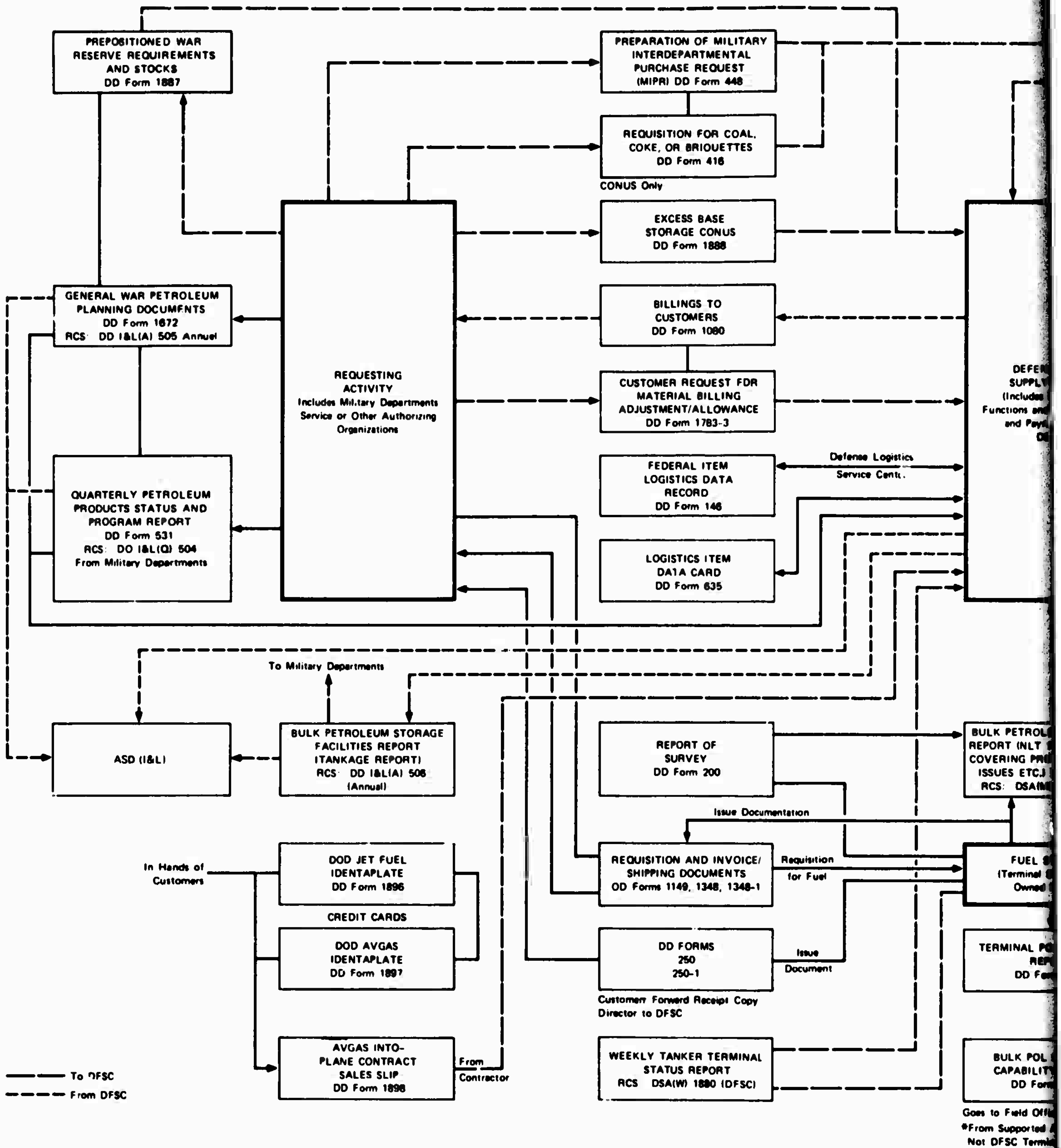
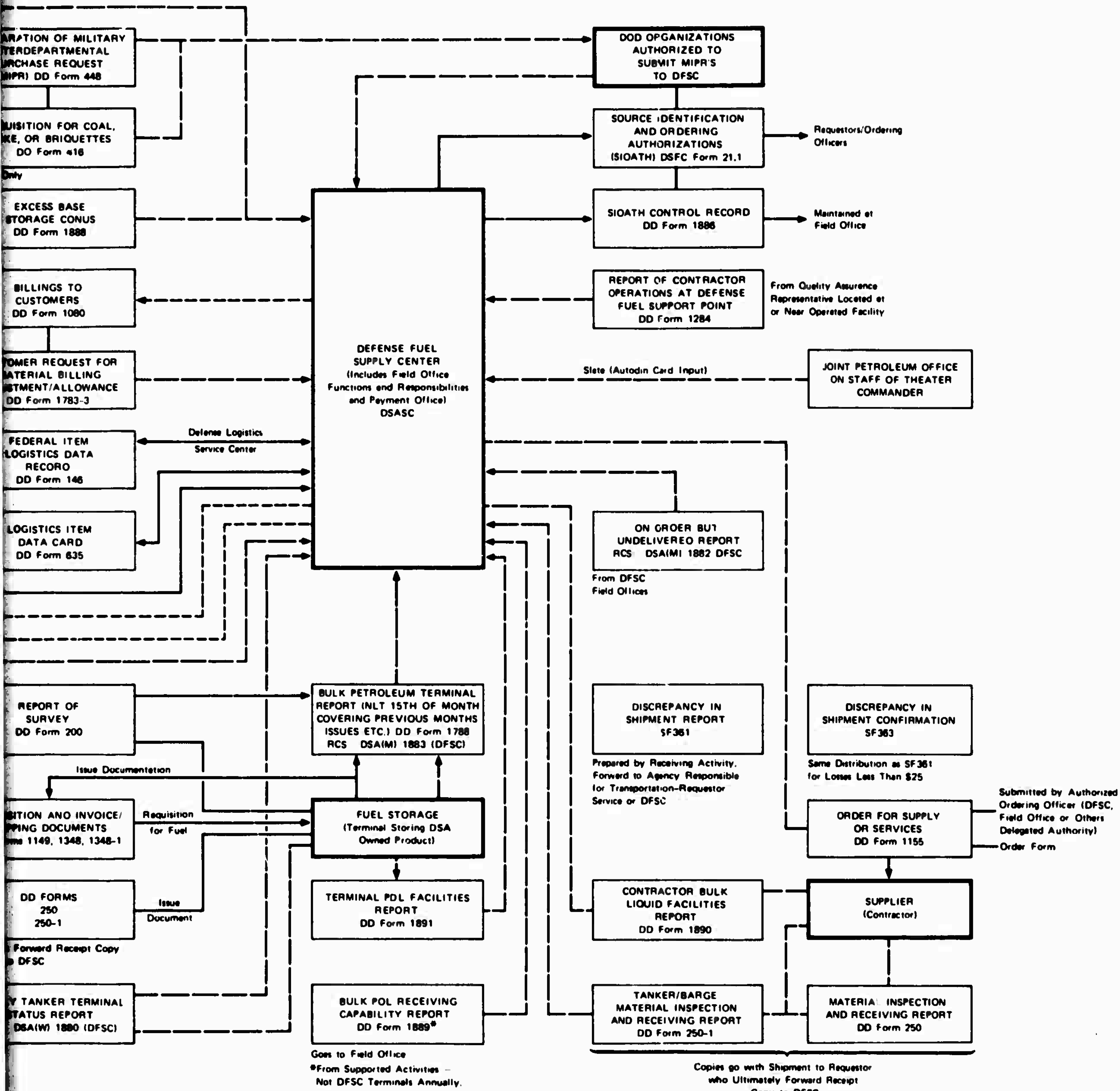


FIGURE 8-5. SCHEMATIC OF PRESENT SYST
MANAGEMENT TRANSACTIONS INVOLV
PETROLEUM PRODUCTS AND COAL



SCHEMATIC OF PRESENT SYSTEM OF DOD
AGEMENT TRANSACTIONS INVOLVING
ETROLEUM PRODUCTS AND COAL

8-25/26

8.4.2 Energy Information System Requirements

An effective DoD Energy Information System (DEIS) must meet as a minimum the following requirements:

- Capacity to cover all energy types
- Flexible to support changing needs of various levels of decisionmakers faced with a wide spectrum of situations
- Easily and quickly accessible to ensure efficient data recovery
- Structured in such a way that data elements are correlatable among data bases
- Capable of handling classified data.

In view of the urgency of energy-related problems developing at the national as well as the international level, an immediate DEIS capability is needed. It would be unrealistic, however, to suggest that all of these requirements can be quickly met regardless of the effort applied. Experience has shown that designing, developing, and implementing an information system of this magnitude is a major undertaking requiring a large commitment of resources.

8.4.3 Factors To Consider in Developing the DEIS

No presently available information system entirely satisfies these requirements. Either a new system will have to be developed or existing computer systems and communications equipment will have to be modified. An appropriate expert technical staff having extensive information systems experience will be needed. The choice of the physical location of the center, which should consider proximity to major users and data bases such as those of DFSC, is another important factor influencing the utility of the DEIS. Also the urgent need for an immediate DEIS capability must be met. To make these choices and integrate the system components in a design that provides the most useful and cost-effective DEIS possible within time and budget constraints will require a total systems approach from the beginning.

8.4.4 Systems Approach to DEIS Development

In view of the urgent need for an immediate DEIS capability, it is clear that any approach starting with consideration of a new computer system must be ruled out. Instead, the system must be developed based on starting with the most appropriate existing capability, namely the information system of the DFSC. Modifying the DFSC system becomes the first effort, but it must be done with a systems approach to permit cost-effective evolution from an immediate capability into a near-term and eventual full capability. How these two phases of the development program may be implemented is outlined in the following section.

8.4.5 Implementation Steps and Schedules

The several steps necessary to develop and begin to employ the immediate DEIS are shown in Figure 8-6. The schedule for these steps is also given in the figure. It should be noted that the schedule covers a 6-month period.

8.4.5.1 Applications Illustrating Design Guides to the Immediate System

How the DFSC structure should respond and contribute to the operation of the immediate DEIS in example situations stressing the system is described briefly:

- Petroleum Supply in Situations Requiring Energy Hardship Decisions

  In a time of energy shortage, it will be necessary to employ procedures to allocate scarce petroleum supplies according to priorities. Allocation decision will require ready access to essential information on fuel quantities, storage, stocks, distribution, and requirements. As indicated in Figure 8-7, the DFSC will provide data for tracking of purchase requests, contracted and delivered amounts, supplies in storage, requisition upon these stocks, and accounting for transfers of funds. Basically, under peacetime hardship conditions the routine DFSC procedures must be modifed to accommodate data flow between DFSC and the DoD management structure designated to handle hardship allocation decisions.

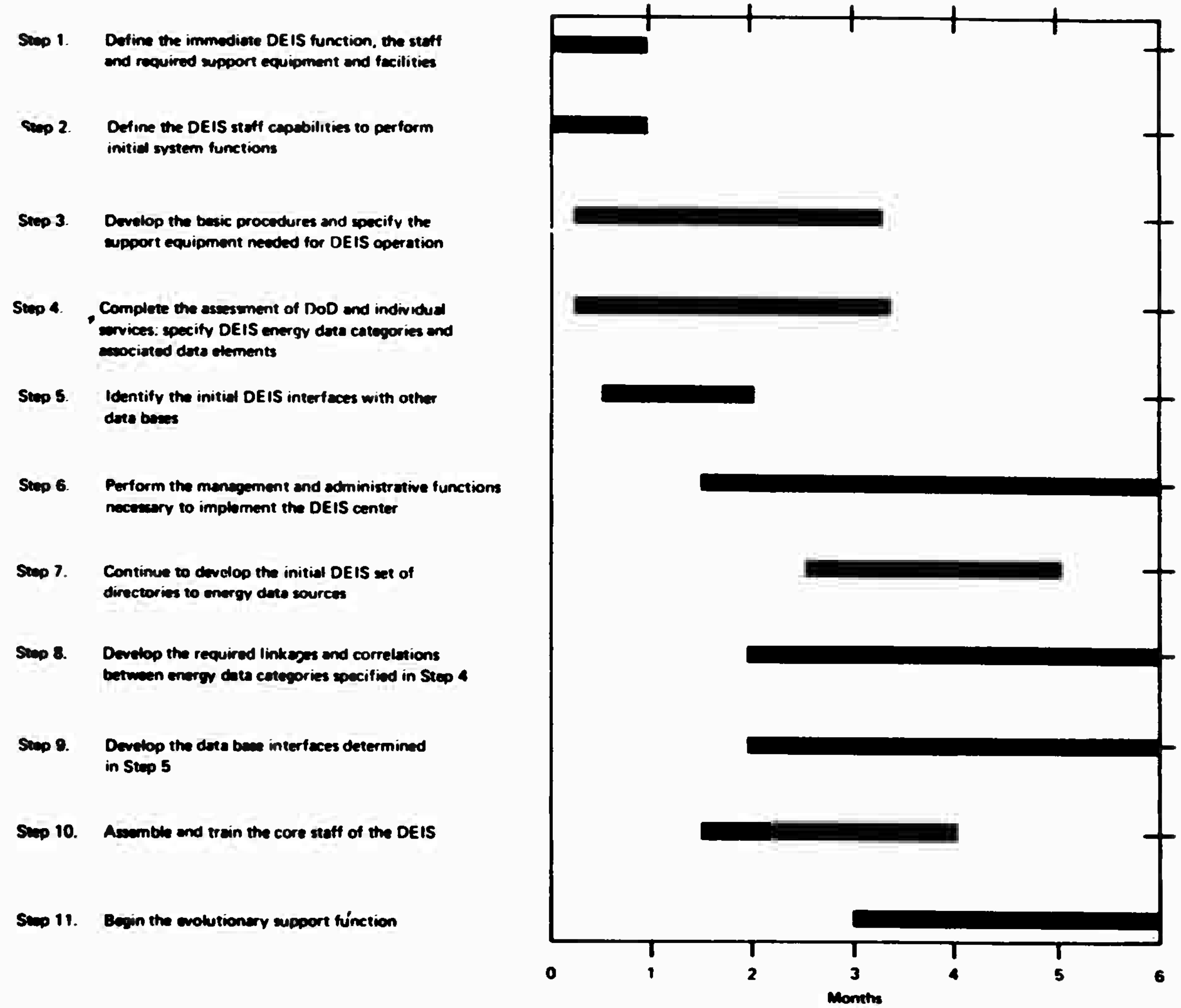


FIGURE 8-6. IMMEDIATE DEFENSE ENERGY INFORMATION SYSTEM DEVELOPMENT SCHEDULE

- <u>Petroleum Supply in Situations Requiring Military Operations Decisions</u>

  Many factors are critical in formulating DoD responses to military operations. In making decisions regarding petroleum supplies, data will be required on priority allocations, near real-time status of supply and distribution, availability of transportation resources, and rapidly changing operational requirements. These factors will create enormous stresses in the routine DFSC data base handling capabilities. Although the core information available in the DFSC may have adequate coverage of these topics in most instances, the decision inputs from DoD management into the DEIS can be expected to alter, in large measure, procedures and processing currently designed to handle routine situations. The capability of DSA computer installations and personnel, even augmented to accomplish responses to operations, will be severely stressed. Contingency plans for use with the immediate DEIS must be developed to address this situation. Such contingency plans will impact on existing data flow. Figure 8-8 is provided to show the basic path through existing DFSC data bases for petroleum supply and demand that would be stressed under operational conditions. The evolution program of the immediate DEIS into the full system capability must address this critical situation in detail.

8.4.5.2 <u>Evolution of the DEIS</u>

The second stage of the DEIS development must evolve from the growing capability of the immediate DEIS and satisfy longer term requirements to include data on the consumption of energy by the Shore Establishment. The design goals for this evolution into the near-term and eventual capability are:

- Increase system capacity (i.e., handle data concerning all energy forms of interest to DoD); service a wider energy community; and provide an analytical capability

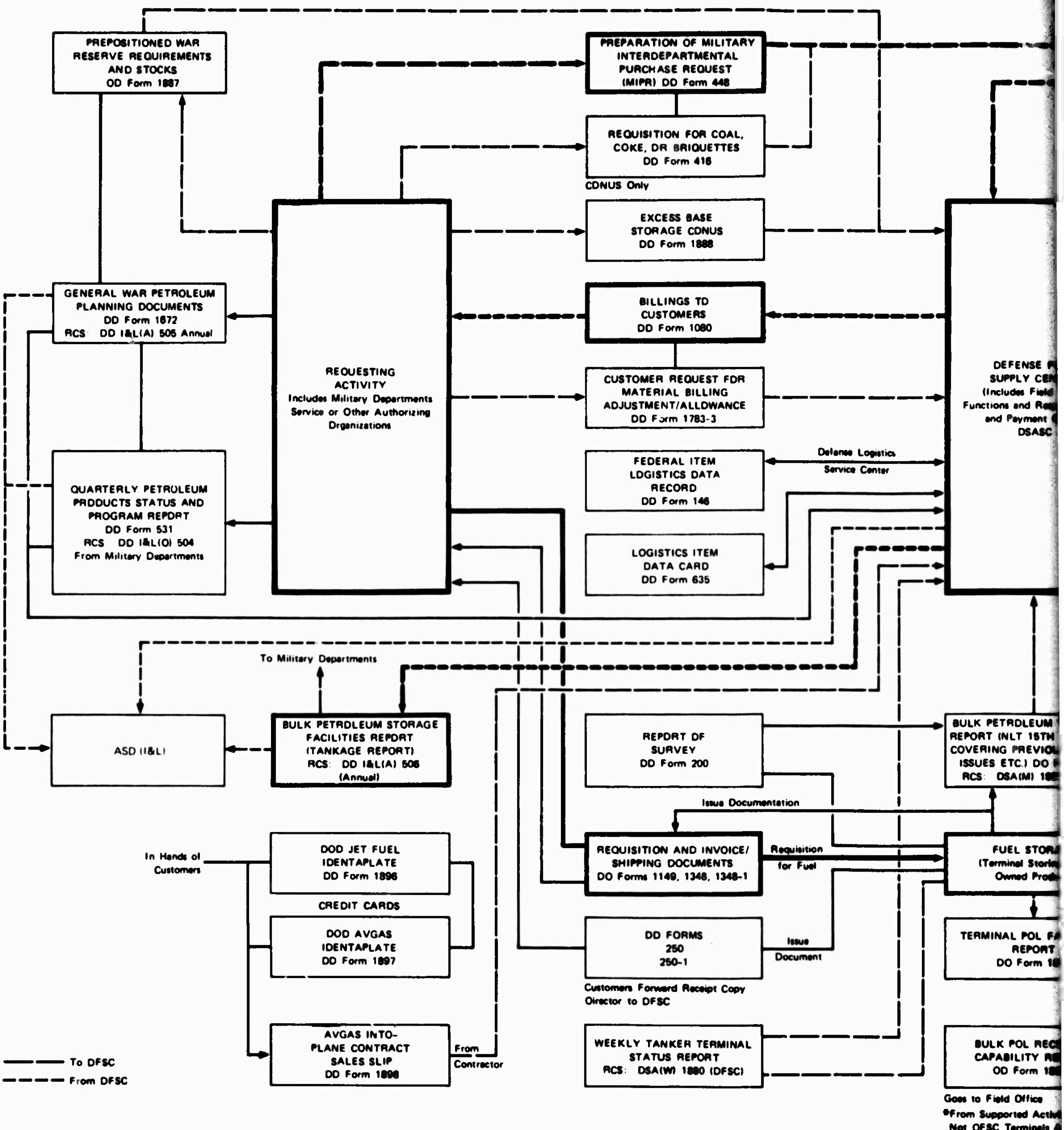
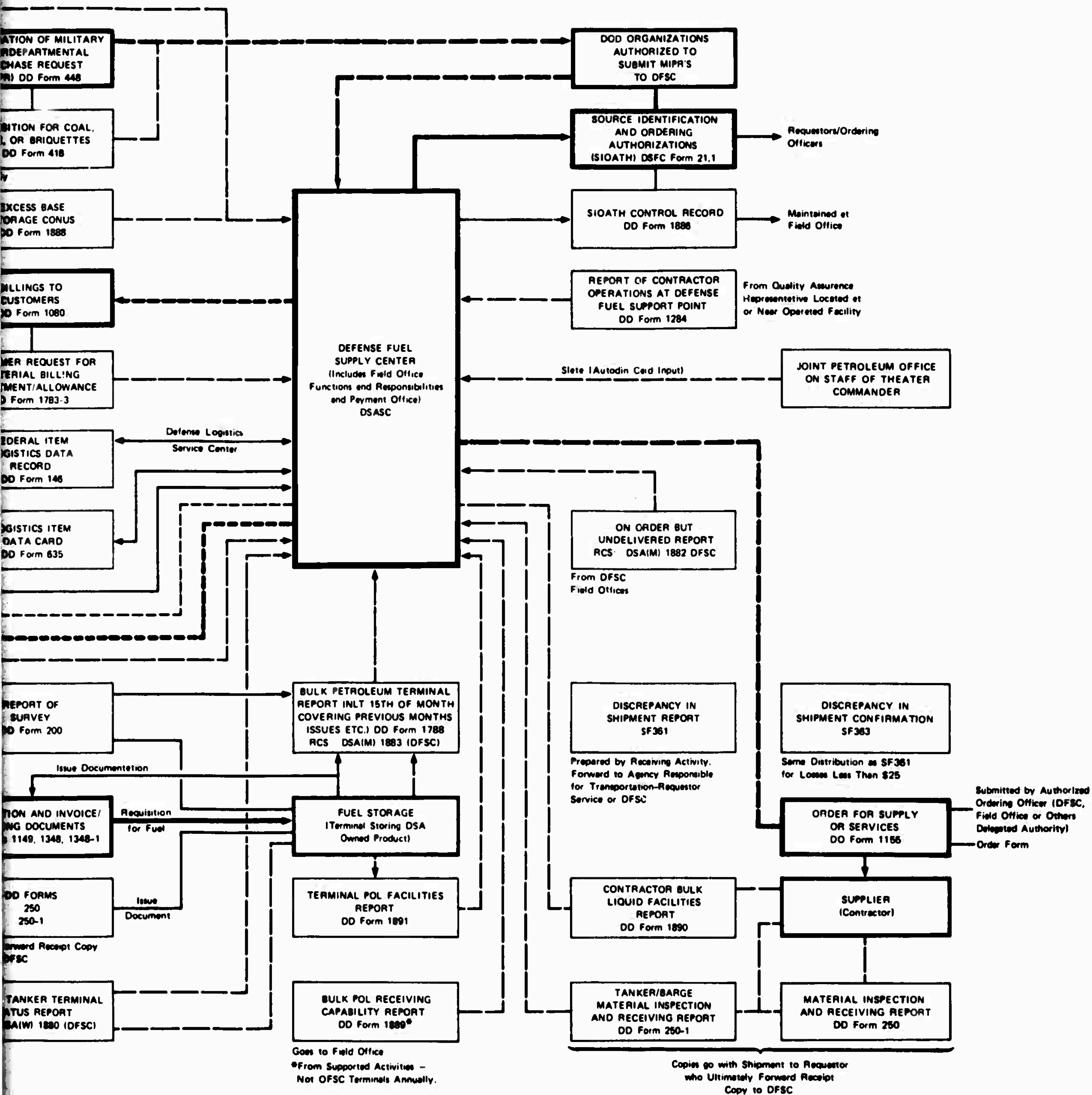


FIGURE 8-7. PROPOSED DOD TRANSACTIONS IN
PETROLEUM SUPPLY IN HARDSHIP CAS



PROPOSED DOD TRANSACTIONS INVOLVING
OLEUM SUPPLY IN HARDSHIP CASES

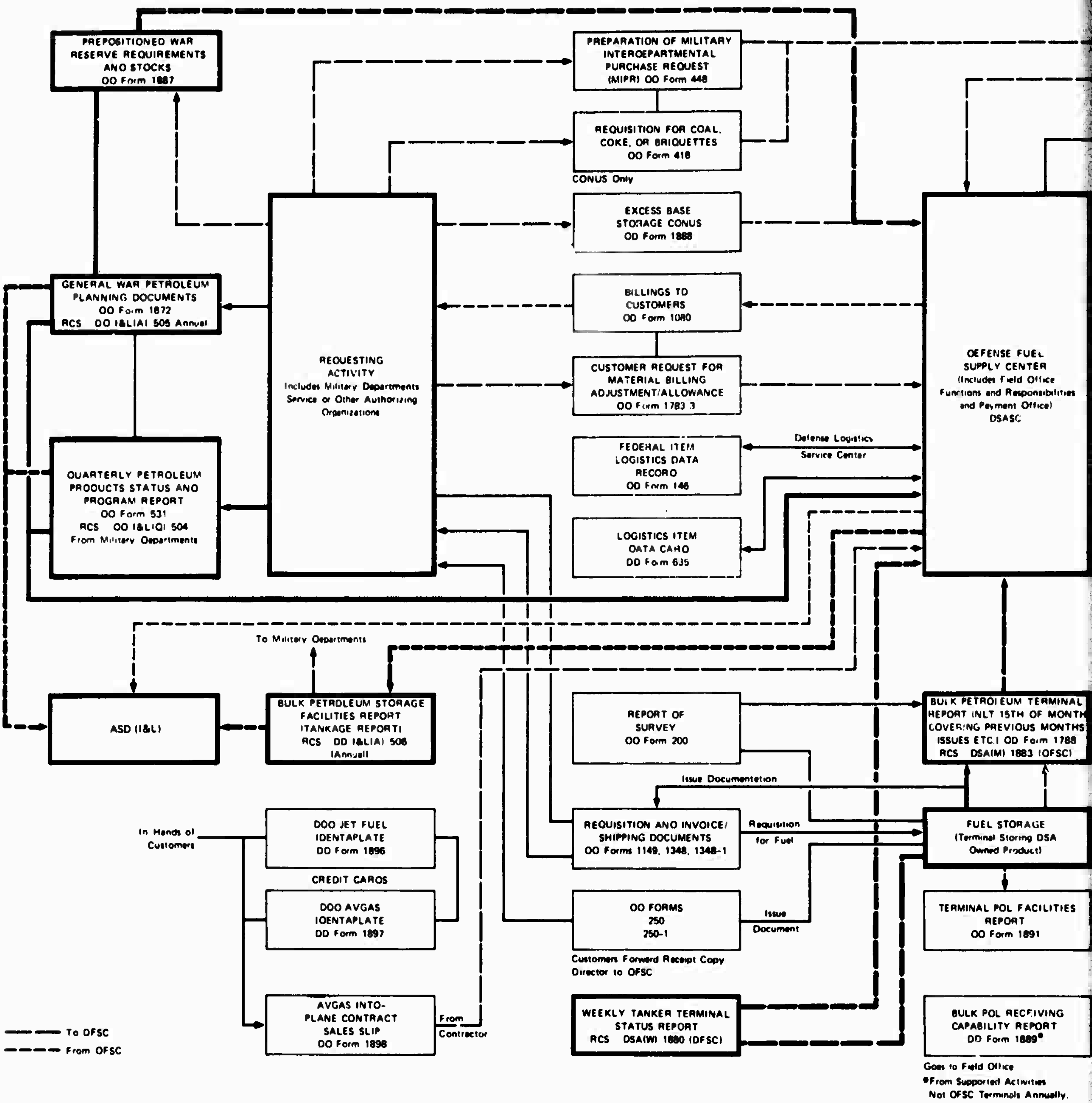
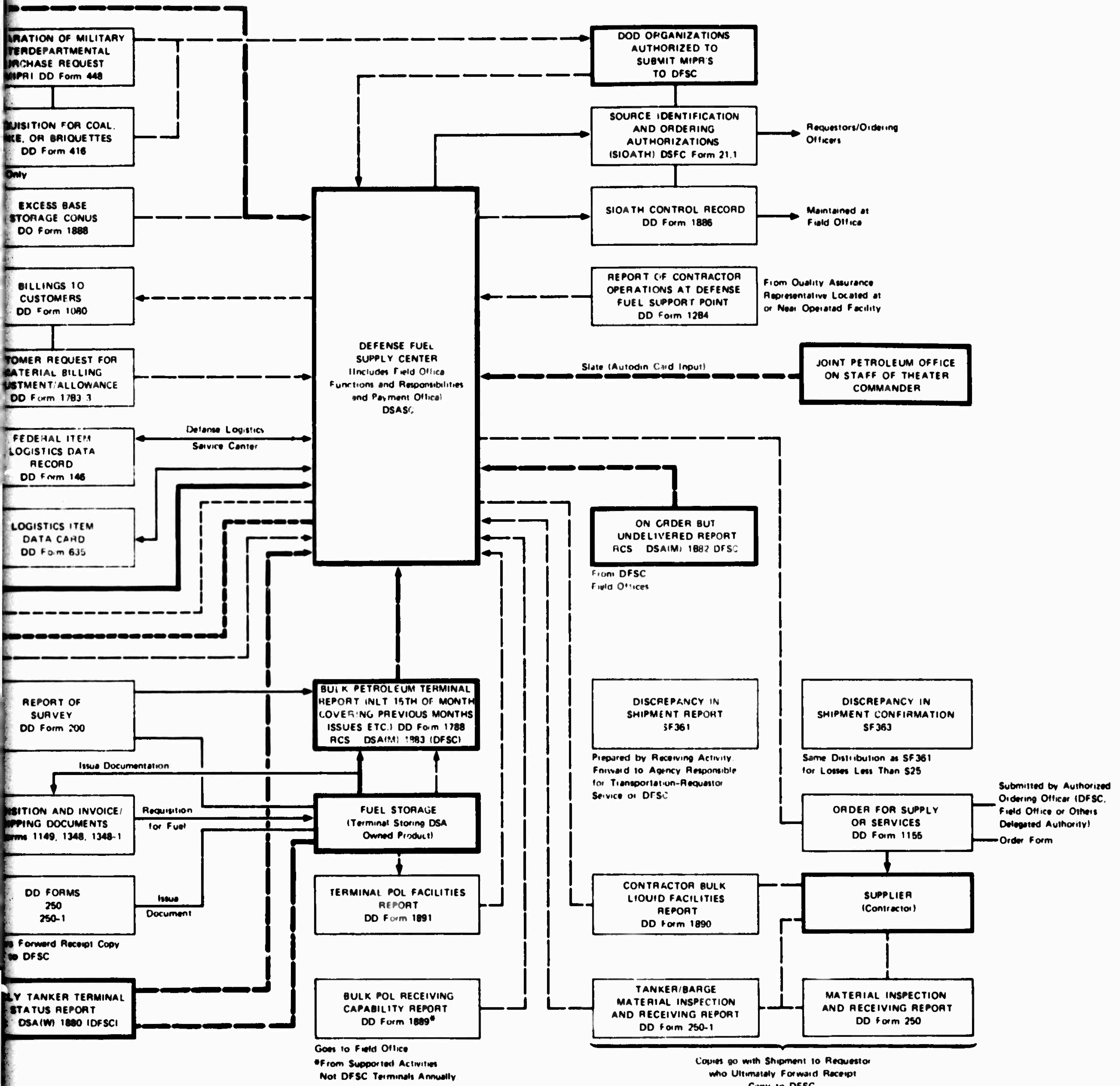


FIGURE 8-8. PROPOSED DOD TRANSACTIONS INVOLV
PETROLEUM SUPPLY IN MILITARY OPERATIONS



PROPOSED DOD TRANSACTIONS INVOLVING
UM SUPPLY IN MILITARY OPERATIONS

- Improve accessibility by methods such as on-line capability and new procedures

- Provide interactions with other resource allocation/ command and control systems.

These goals imply that the evolutionary program must include effort to investigate the use of advanced computer technologies such as remote access to data bases and computer networks.* These efforts should be part of a modular design approach defined by a system development master plan. This plan must reflect time and budgetary constraints—their early definition will facilitate development of the master plan.

8.4.6 DEIS Cost Estimation

The major portion of the initial system costs is the manpower required for the system development and for the operational capability to be phased in about the third month. It is estimated that the initial manpower will average at about a 10-man level over the first 3 months with the following 3 months requiring an average level of 16 professionals, exclusive of clerical support. Support personnel, system operation, and maintenance costs are not included, but are subsumed under present costs.

Hardware costs can be estimated assuming that the DSASC computer system is used initially and that the only modifications during the first 6 months are the addition of terminals and associated communications equipment plus augmentation of computer storage and output capabilities. These hardware modifications are estimated to range from $150,000 to $250,000.

Cost estimates for the longer term DEIS development are dependent on system design decisions yet to be made and are thus difficult to project. A full capability DEIS will require increasing manpower for system development and operation with a growth to

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*An example is a computer network system of the type that is being developed by WWMCCS, which is scheduled to be implemented with an initial operating stage in 1975 evolving to a full capability in the early 1980's.

20 to 30 people likely to be attained before a plateau is reached. Assuming that a dedicated computer system will be acquired since the present DSA computer will become saturated in the near future, the purchase hardware system costs will be in the $4 million to $7 million range.

8.5 CONCLUSIONS

- There is no clearly defined focal point for energy matters in DoD.
- The DoD organization is not presently constituted to handle effectively the anticipated daily operational energy problems of allocations and priorities.
- The Uniform Materiel Movement and Issue Priority System (UMMIPS) is the only official priority specifier within DoD.
- The Joint Materiel Priorities and Allocations Board (JMPAB) is the only organization dedicated to the allocation of materiel within DoD.
- There is no total energy information data base within DoD at present.
- Only in the fuels area, managed presently by the Defense Fuel Supply Center, is there a substantial amount of organized data covering all of DoD.

8.6 RECOMMENDATIONS

8-1. The Secretary of Defense should establish a Defense Energy Policy Council and an Energy Hardship Panel at the OSD level to approve major energy policies and to resolve DoD energy allocation matters.

8-2. The Assistant Secretary of Defense (Installations and Logistics) should establish a Directorate for Energy reporting directly to the ASD(I&L).

8-3. The Services should establish a centralized organization for energy matters comparable with and responsive to the OSD organization.

8-4. The Joint Chiefs of Staff should consider establishing a new organization within the OJSC, patterned after the Joint Transportation Board, should the JMPAB prove inadequate for advising the Energy Hardship Panel.

8-5. The Assistant Secretary of Defense (Installations and Logistics), the Services, and the Commanders in Chief should consider using the UMMIPS, with modifications, to indicate priorities for energy allocation.

8-6. The Defense Supply Agency should develop a Defense Energy Information System (DEIS), as soon as possible, based on the Defense Fuel Supply Center's data bases and procedures.

8-7. The Assistant Secretary of Defense (Installations and Logistics) should establish a standardized reporting format for all the Services as soon as possible to provide a uniform data base on which the immediate DEIS can be built.

8-8. The Assistant Secretary of Defense (Comptroller) should provide resources to DSA to augment its computer system and personnel to support the DEIS development.

8-9. The Assistant Secretary of Defense (Installations and Logistics) should prepare a DEIS System Development Master Plan including requirements, parameters, and interfaces with other information systems, to guide the evolution of the immediate DEIS into the near-term and eventual full-system capability that will include facilities data.

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APPENDIX

ENERGY CONVERSION FACTORS

Prepared by the Defense Energy Task Group

Energy Content of Fuels	Crude Oil Equiv., Barrels [1]	British Thermal Units (Btu) [2]	Kilowatt-Hours (kwh)
Anthracite coal, short ton	4.38	25,400,000	7440.0
Bituminous coal, short ton	4.24	24,580,000	7240.0
Average coal, short ton [3]		24,020,000	7040.0
Automotive gasoline, gallon	0.0216	125,000	36.6
Aviation gasoline, gallon	0.0216	125,000	36.6
Jet fuel kerosene type, gallon	0.0234	135 000	39.5
Jet fuel naphtha type, gallon	0.0219	127,000	37.2
Kerosene, gallon	0.0234	135,000	39.5
Diesel oil, gallon	0.0239	138,700	40.7
Distillate fuel oil (#2), gallon	0.0239	138,700	40.7
Distillate fuel oil (#2), barrel [3]	1.004	5,825,000	1,707.0
Residual fuel oil, gallon	0.0258	149,700	43.9
Residual fuel oil, barrel [3]	1.084	6,237,000	1,843.0
Natural gas, standard cubic foot (SCF)	0.000178	1,031	0.302
Liquified petroleum gas, SCF (including propane and butane)		2,522	
Electricity, Btu of fuel consumed at power plant per kwh delivered to consumer (assume 10,536 Btu/kwh station heat rate for all stations, 9% line loss as reported for 1971 by Edison Electric Institute)	0.0020	11,600	3.40
Steam, Btu of fuel consumed at boiler plant per pound of steam delivered to consumer (assume 1000 Btu/lb of steam generated, 82% boiler efficiency and 12% line loss)	0.000196	1,390	0.407

1 kwh	=	3.600×10^6 joules (J)	=	859.9 kilocalorie (kcal)	=	3412 Btu
1 horsepower-hour (hp-hr)	=	0.746 kwh	=	2545 Btu		
1 J	=	2.778×10^{-7} kwh	=	.2388 cal	=	9.478×10^{-4} Btu
1 Btu	=	1.055×10^3 J	=	2.931×10^{-4} kwh	=	.2520 kcal

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[1] Converted from Department of Interior (DOI) figures using 5.80×10^6 Btu/bbl crude oil (42 gal/bbl).

[2] This Btu column is based on DOI conversion factors of 22 August 1973.

[3] Used in the DoD Matrix II Report RCS DD - I&L (ARNQ) 1284.